NATIONAL MUSEUM OF VICTORIA

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VICTORIA · · · AUSTRALIA

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Issued under the direction of the Hon. E. J. Hogan, M.L.A., Minister of Agriculture.

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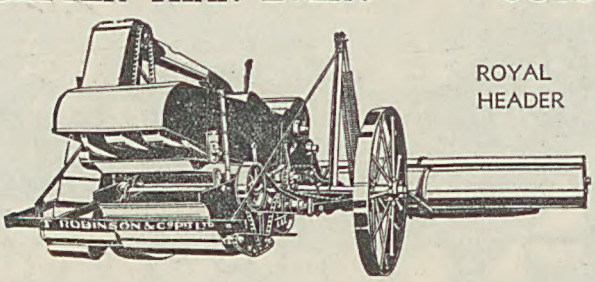

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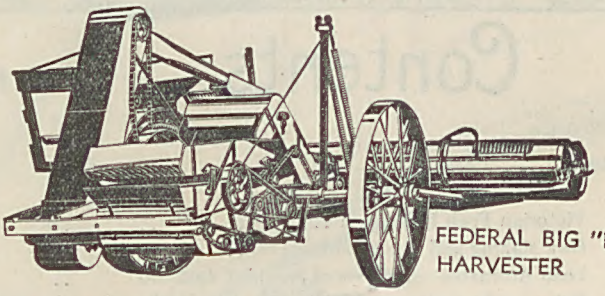

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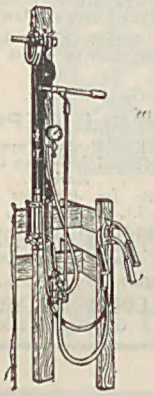

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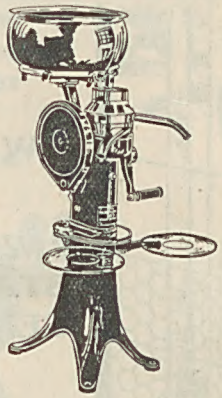

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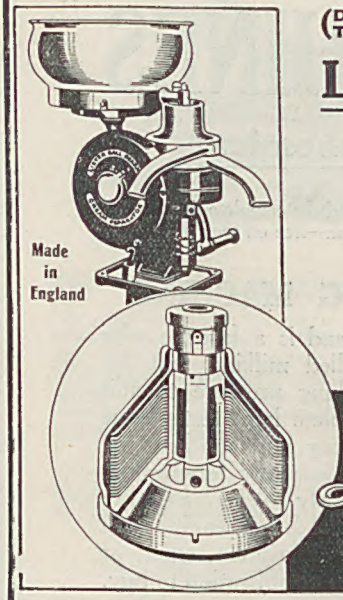

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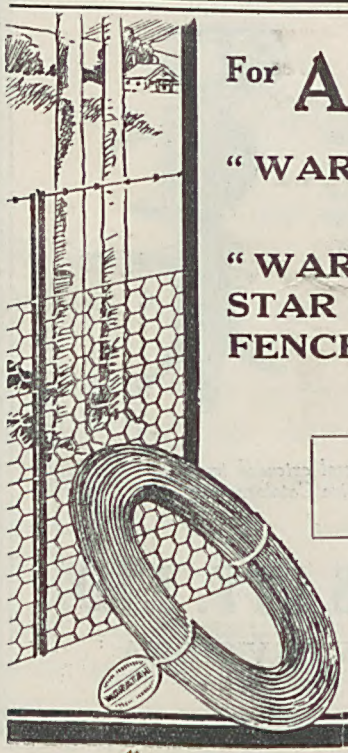

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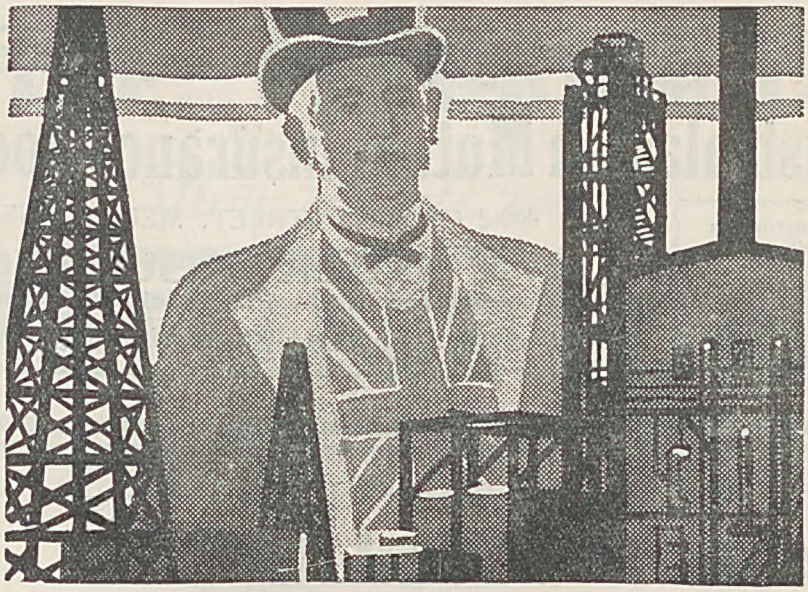

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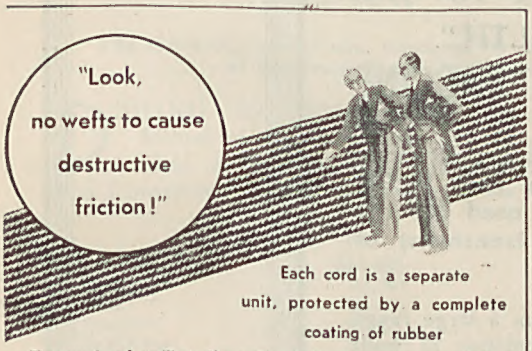

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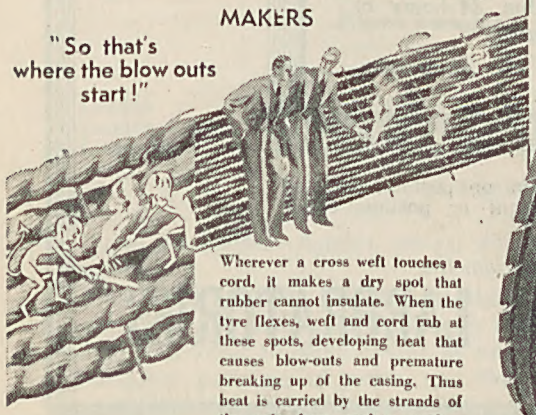

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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Victorian Fruit in London

Review of 1935 Export Season

The following report was prepared by Mr. S. R. McColl, Commercial Officer, and Mr. F. White of the Trade Branch of the London Office of the Agent General for Victoria

DURING the 1935 export season, the following fruit was shipped from Victoria in 49 steamers to United Kingdom and Continental ports, as set out below:—

APPLES.

London	317,865
Liverpool	42,361
Hull	65,604
Glasgow	35,255
Hamburg	33,600
Antwerp	1,500
Hook of Holland ...	10,683
	506,868 packages

PEARS.

London	290,268 bushel cases
London	15,781 standard cases
London	40 half-bushel cases
Liverpool	13,513 bushel cases
	319,602 packages

PLUMS.

London	962 bushel cases
London	13,119 half-bushel cases
Liverpool	2,105 half-bushel cases
	16,186 packages

Total packages.—Apples, pears, and plums, 842,656.

Compared with the 1934 season, these figures represent a decrease of 197,926 cases of apples, which was offset to some extent by an increase of 103,395 packages of pears, and the equivalent of 10,529 half-bushel cases of plums.

As in previous seasons, and with few exceptions due to pressure of work, inspections were made of all consignments at the ships' side during the discharge of the fruit. Regular inspection of consignments was made at the Spitalfields Market; also at Covent Garden and the Borough Market Auction Sale room controlled by J. O. Sims, Limited.

Owing to the regularity of weekly arrivals at the Port of London, and the necessity of giving first attention to these consignments, it was found possible to visit Liverpool and Hull on only one occasion each, while no inspections were made at Glasgow, or any of the Continental ports. Wherever possible, however, arrangements were made to secure from the merchants at these ports reports, which were included in the general report for each shipment forwarded to the Department of Agriculture.

Every effort was made to cover as many individual marks and varieties of the various fruits as possible, and whilst the total number of cases examined might represent a relatively small part of the total shipments from Victoria, it is considered that sufficient fruit was seen to justify a general review of the condition, quality, &c., of Victorian fruit shipped throughout the season. Full details of the results of the examinations made on each individual shipment have been forwarded to the Department of Agriculture.

Apples.

Generally the apple consignments turned out satisfactorily from the point of view of both condition and quality. In each shipment there were some marks not up to standard and reference is made to these later. The grading and packing of the fruit were of a uniformly high standard, and these factors, together with careful handling and transport in Victoria, were responsible for reducing the quantity of bruised fruit to a minimum. In comparison with last season's outturn, the all-round improvement was most marked.

So far as colour grading was concerned, there was definite evidence that the majority of growers had complied with the minimum set in the regulations. Others definitely made very little attempt to colour grade their fruit, and in the case of the Jonathan variety, particularly with the early shipments, lost the cream of the market by not doing so. It is generally recognized in the trade that buyers prefer apples showing a maximum amount of colour. New Zealand and Argentine are able to supply Jonathans showing this colour requirement in the early shipments, and consequently realize better prices than Victorian partly coloured fruit. During the week the fruit *ex* s.s. *Napier Star* was marketed the following prices were realized for apples from the three countries above mentioned:—

	s. *d.*		*s.* *d.*
Argentine.—Jonathans ..	11 0	to	11 6
New Zealand.—Jonathans	9 6	to	13 0
Victorian.—Jonathans ..	8 9	to	11 0

American Winesaps also are available at this time to compete with Victorian early varieties. Winesaps, as is well known, are highly coloured apples, well graded and packed, and although they lack the freshness of new season apples through long cold storage, they are in keen demand and are definitely preferred to our Jonathans with little or no colour. In the same week as that quoted above, Winesaps realized from 9s. to 10s. 3d. a case. There is one other competitor which should be mentioned. South Africa is shipping each year increasing quantities of early season dessert varieties of apples. The fruit is of excellent quality and maintains the high standard of grading and packing, which this country has set with her other fresh fruits.

Growers should aim to raise the standard of their grading above the minimum fixed by regulations, and approach as closely as possible that set by their competitors. It is essential, in addition to the colour requirement, that the apples should land with a bright fresh appearance and with a minimum of skin marking. Too many Jonathans were seen this season showing severe spray russet, which was frequently associated with a dull and shrivelled appearance.

Again, there were growers who packed apples as "Fancy" grade, when the colour and quality warranted "Extra Fancy." It should be the endeavour of growers to send as much "Extra Fancy" fruit as their orchard will allow. By so doing they will enhance the reputation which Victorian fruit holds, and obtain a margin over the "Fancy" grade pack. The buyer is definitely impressed by the "Extra Fancy" grade, which is the universal top quality of other exporting countries. It is frequently useless to try and convince the buyer that the box marked "Fancy" is actually "Extra Fancy" quality. Even if he knows it is he will take advantage of the failure of the grower to brand his fruit to its true merit. Growers are again urged to grade and pack not to the minimum of the Commerce Act Regulations, but, wherever practicable, to a higher standard. While it is quite true that anything can be sold in the United Kingdom markets at a price, it is an indisputable fact that only the best fruit will bring top prices.

The outstanding defects in Victorian apples during the season are as indicated below. It should be noted that these references cover only a relatively small proportion of the total shipment, the general condition of the apples, as stated earlier, being considered satisfactory:—

(*a*) Bitter pit.
(*b*) Dull and shrivelled appearance of Jonathans.
(*c*) Excess black spot.
(*d*) Excess spray russeting.
(*e*) Jonathans and Rome Beauty below colour requirements.

In addition, there were odd lots affected with excess arsenical spray residue, fungal rot, mouldy core, and one small lot with brown heart. Many case of apples came under notice where packers had included several inferior apples in an otherwise good quality pack. These defective apples come under the notice of keen buyers, who naturally think that there may be many more similar apples in the case,

Apples packed for Export in the Standard Case.

and pass them over for a better lot, or reduce their estimate of its value accordingly.

The defects previously mentioned will be dealt with in the order quoted:—

Bitter Pit.—This disease was much less severe than in the 1934 season. It commenced, however, in the first shipment, and was seen in Cox's Orange Pippin, Reinette du Canada, Dunns, Jonathans, Granny Smith, London Pippin, Pomme de Neige, Cleopatra, and King David varieties, but with odd exceptions it was only slight and did not affect the value of the fruit to any extent. Some Cox's Orange Pippins were in a bad state, as will be realized from the prices varying from 8s. up to 20s. for sound fruit. The pit remained right up to the *City of Winchester* shipment, which arrived on 4th June. During this period only some marks and varieties were affected and to a slight extent only. The majority of the consignments were quite free from the disease.

Dull and Shrivelled Jonathans.—While there were many excellent consignments of Jonathans throughout the season, there were many others which opened up with a dull and shrivelled appearance. In many instances this condition was associated with severe russeting of the skin, and it is suggested there may be some connexion between the two. Buyers know this variety well, and they look forward to receiving a bright, good coloured, and clean skinned fruit. It is also well to mention here that a few lines of Jonathans lacked the characteristics of this variety. They had the appearance of undernourished fruit and were of exceptionally poor quality. This type of fruit must fail to realize remunerative prices.

Excess Black Spot.—While not unmindful of the difficulties incurred by growers last season in controlling the black spot fungus in Victoria, it must be recorded that there were far too many lines showing considerably more black spot than the tolerance allowed by regulation. This class of fruit invariably realized shillings a case less than clean fruit.

Spray Russeting.—The injury caused to some varieties of apples this season through excessive spray russeting was most pronounced. The Jonathan, Granny Smith, King David, Cleopatra, and Dunns varieties were perhaps the worst affected; the former two varieties particularly. If this injury has been caused by the excessive strength of the spray used, it is suggested that remedial measures be taken to prevent a recurrence. Growers would be ill-advised, particularly in the case of the Granny Smith variety, to ship fruit of this kind. The Granny Smith is an outstanding apple on the United Kingdom market, and its characteristics must be preserved at all costs. In this latter connexion it is as well to mention that some apples of this variety were not recognized as such. They were definitely not up to type. A reference to Jonathans affected with spray russeting is made earlier in this report.

Some Jonathans and Rome Beauty below colour requirements.—As stated earlier, most growers graded these and other colour varieties to the colour requirements of the respective grades, but in the early shipments of Jonathans there were quite a few lines below standard. With regard to the Rome Beauty variety, later in the season, it must be stated that there was a fair number of marks without any colour whatever. When well-coloured samples of this variety are seen alongside green ones at the same sale or warehouse, the buyer will always give preference to the coloured fruit and pay an extra 1s. per case to obtain it, particularly if it is for dessert use. Even the 10 per cent. colour requirement for this variety in the "Fancy" grade makes all the difference when

compared with all green fruit. These remarks apply equally to Jonathans and other coloured varieties.

Other Defects.—The amount of fruit injured by fungal rot, bruising, and mouldy core was exceptionally small, and certainly not sufficient to warrant any great comment, except to say that in the case of fungal rots and bruising, the amount of damage could be further reduced by a little more care on the part of the grower concerned in the better selection, grading, and packing of the fruit.

Outstanding Varieties.

There are quite a few outstanding varieties from some growers. Alfristons, London Pippins, Dunns, Statesman, King David, Granny Smith, and Jonathans were among those which frequently came under notice for their fine condition and excellent quality.

Prices Realized.

The opening prices realized for Victorian apples *ex* s.s. *Otranto* were as follow:—Jonathans, 11s. to 13s.; Alfristons, 8s. 6d. to 10s. 6d.; London Pippins, 8s. to 10s.; Reinette du Canada, 7s. to 8s. 6d.; Dunns, 8s. 6d. to 10s. 6d.; Cox's Orange Pippin, 8s. to 20s. (variation due to the degree with which apples were affected by bitter pit); Delicious, 10s.; King David, 10s.; Duke of Clarence, 9s. 6d. to 10s.; Pomme de Neige, 8s. to 9s.; Wellington, 7s. 6d. to 8s. 6d.; Ribstons, 8s. to 8s. 6d.; Cleopatra, 8s. 6d. to 10s.

Prices kept round this level most of the season with the exception that the range of prices for Jonathans after the first shipment was 8s. to 10s. 6d. with odd high quality lots making up to 12s. Granny Smiths later made from 10s. to 13s. During the latter part of the season, owing to the failure of the English soft fruit season, and with limited supplies of apples available, prices appreciated quite a lot, Jonathans making 12s. to 13s.; Yates, 10s. 6d. to 13s.; London Pippin, 10s. 6d. to 11s.; Rokewood, 12s. to 14s.; Cleopatra, 11s. to 12s.; Granny Smith, 13s. to 16s.; Dunns, 11s. 6d. to 12s.; Democratic, 11s. 6d. to 13s.; Newtowns, 11s. 6d. to 12s.; Statesman, 11s. to 12s. 6d.; Rome Beauty, 10s. to 13s. 3d.; Stone Pippin, 11s. to 12s.; and Sturmer Pippin, 11s. to 11s. 6d.

The prices realized at Liverpool, Hull, and Glasgow generally were mostly on a par with those obtained in London, and on a few occasions were slightly better.

Pears.

It is very gratifying to record the success of the Williams Bon Chretien pears *ex* R.M.S *Mongolia*. This consignment arrived in a 100 per cent. sound condition and definitely proved that, if picked at the correct stage of maturity, precooled at once, well graded and packed, and given reasonable care in handling, this delicate pear can be marketed in London with confidence. The consignment in question was well received and very favorably commented on. Unfortunately, when the consignment arrived the market was rather depressed following the arrival of fairly large supplies of the same variety from the Argentine and South Africa. Ripe Williams Bon Chretien from the latter country the previous week sold as low as 2s. per case. The price, ranging from 8s. to 11s. for the Victorian pears, therefore should be considered satisfactory.

The good condition obtaining in the first shipment of pears was a happy augury for subsequent consignments of other varieties, for with few exceptions, right throughout the season, the Victorian pears consistently opened up in a good sound condition. In the majority of the shipments the pears arrived in a hard to firm condition with odd lots showing varying degrees of ripeness. In a few shipments small parcels of frozen pears were found, probably due to the cases being stored too close to the grids, or, where a battery system of cold storage was operating, to their catching the

Williams Bon Chretien Pears Packed for Export.

A typical scene at Port Melbourne. Loading apples and butter for the United Kingdom.

full force of the cold air from the inlet trunk. It is not always possible to detect this injury in the warehouse immediately on delivery of the fruit, but when it is found the matter is at once brought under the notice of the shipping company, and a claim is lodged for the damaged fruit. Instances have been noted where frozen pears have been sold in good faith to buyers, who have held them for a week and then returned them in a more or less useless condition. When this occurs it is difficult to press a claim against the ship. Fortunately, there were not many cases sold in this condition.

Grading and Packing.

The grading and packing, with few exceptions, were uniformly good throughout the season. Some rather small and poor quality Vicars and Broom Park varieties came under notice and these realized very low prices. On some shipments Keiffers arrived in a forward condition, which was accompanied by severe black skin marking.

Defects.

With the exception that some pears arrived in a forward condition, the only defects worth mentioning are as follows:—

(*a*) Severe spray russeting;
(*b*) Black spot;
(*c*) Arsenical spray residue;
(*d*) San José scale.

Severe Spray Russeting.—This injury is one that has been the cause of complaint by buyers. Several varieties of pears were affected but none to the extent of the Packham variety. In many consignments, in each shipment, this pear showed severe spray russeting, whilst there were other lots of this variety with clean bright skins. The reference previously made to the severe russeting of apples is equally applicable to pears, and although the grower has had cause to spray his trees frequently to combat the black spot fungus, it is suggested that the strength of the spray may have caused the trouble. This pear is very popular in this market, and accordingly its quality should be protected, if at all possible.

Black Spot.—It is considered that more care was taken in culling excess black spot in the pears than in the apples; nevertheless, there were many lots which exceeded the tolerance allowed for this disease. The proportion of fruit affected, however, would be relatively small in the total pears shipped.

Arsenical Spray and San José Scale.—There were not many instances where excess arsenical spray and San José Scale came under notice but growers, who packed this fruit, would be well advised to refrain from shipping pears showing these defects.

Prices Realized.

The prices realized for good hard conditioned pears up to Easter were very satisfactory, Comice, Packhams, Beurre Bosc, and Anjou making 15s. a bushel case with odd lots 1s. to 2s. higher; Winter Cole, Josephine, Winter Nelis from 10s. to 13s.; and less popular varieties from 7s. to 11s. Following the Easter trade, prices dropped 2s. to 3s. per case all round, the top price for Packhams, Beurre Bosc, Josephine, and Winter Nelis being 12s. a case.

This fall was attributed to several factors. At this time there were fairly heavy arrivals of pears from Australia and New Zealand. Up to the 7th May, compared with the corresponding period last year, there was an increase of 99,000 cases. Following pre-Easter buying demand was slow, due to cold weather, and a further holiday for the Jubilee on the 6th May interfering with buyers' operations. The general lack of interest shown by buyers resulted in another fall, and about the 15th May, best varieties were selling at from 8s. to 10s. per case.

A further influence on the drop in prices was the effect of fair quantities of ripe pears from both Australia and New Zealand being available at this time, and which failed to clear promptly. However, this position did not last very long. The market appreciated about the 29th May, and on the 19th June, best quality Winter Nelis, Packhams, Beurre Bosc, and Josephine sold at 16s. to 18s. Later shipments did even better, up to 25s. case for Packhams, Josephine and Winter Nelis being obtained with Winter Cole and Beurre Bosc making 21s. Keiffers and Broom Park also sold well at this time at from 13s. to 18s. per case.

There were three consignments of pears shipped to Liverpool in the early part of the season. These arrived in good condition, were well received, and made very satisfactory prices.

Plums.

Although the condition of the plums showed some improvement on the 1934 shipments, there was too much variation for the consignments as a whole to be considered satisfactory. While some varieties from certain growers were well graded and packed, and arrived in quite good condition, others showed no attempt at grading and consequently opened up in varying degrees of ripeness. Even in many of the graded marks the condition was unsatisfactory, due to the fruit being packed at either an immature or too forward stage. It is difficult to advise growers as to the stage at which plums should be picked to arrive in the United Kingdom in a hard or very firm condition. The grower will need to exercise some judgment from the results obtained in previous shipments, but he should bear in mind that while picking on the green side is advocated, care must be taken to see that they are reasonably well developed.

In each of the three shipments in the majority of the marks examined, and in most varieties, internal discolouration of the flesh was seen. This is a serious injury to the plums and one, which if not overcome, will seriously prejudice the establishment of this fruit on these markets. It was more prevalent in some varieties than in others, and generally was more severe in the riper fruit.

It was noticed also that some plums, which opened up in fairly good condition on discharge, did not hold up at all well a few days later. Deterioration was rapid when "the cold left the plums," which indicates that the plums should be sold as soon as possible after discharge. Some plums also developed a bladderiness, but this injury was not a particularly serious one this season.

It is considered that until the internal discolouration injury is overcome, the export of plums must continue to be a speculative proposition, and one that must fail to secure the confidence of buyers from season to season.

Apart from small supplies from the Argentine, Victoria has the plum market to itself during the period of her shipments. Plums in *good* condition are well favoured and realize very remunerative prices.

During this past season well-graded and reasonably sound fruit made up to 10s., with

odd lots reaching 12s., per half-bushel case. Such prices warrant every care being exercised by growers in packing nothing but the best. Inferior quality and poorly-conditioned fruit of any kind always bring poor prices, and when plums are in this way they are sold for very unremunerative returns. There were some instances where the half-bushel cases were sold at a "firewood" rate of 6d. per case.

Some comments on the general outturn of the general varieties shipped this season are shown hereunder:—

Grand Duke.—Fairly good condition, showed little injury from internal discolouration in some marks, but in other immature and over-ripe lots was very severe.

President.—Also fairly good, but not as consistently good as Grand Duke.

Satsuma.—Very fair. Inclined to bladderiness. Unpopular with some buyers on account of keeping quality.

Green Gage.—Only one or two lots of this variety seen. A well-known variety on this market. One parcel realized 12s., others 7s. to 8s. per half-bushel case.

Coe's Golden Drop.—Fairly satisfactory. Some lots did not hold up well after discharge.

Pickering, Blue Belgium, and Jefferson.—Only a few cases of these varieties were seen, but the condition of those examined, and prices realized, justify further quantities on trial.

Premier.—A very attractive plum externally, particularly well graded and packed, but was seriously affected with the internal discolouration injury, which became more severe as plums coloured. In the *Mongolia* shipment the plums never ripened, but developed tough and leathery qualities, and went almost black inside. Should find an excellent market if this injury can be overcome.

Diamond.—Unsatisfactory. Subject to severe internal discolouration. Some lots bladdery, others over-ripe.

Giant Prune.—An unknown and unwanted variety. Very green condition. Severe internal discolouration. Many sold at 6d. per case.

Handling of Fruit at Docks.

During the visits to the docks, particular attention was given to the manner in which the fruit was discharged from the holds and stacked in the sheds. In comparison with the previous season a big improvement was seen, but there were still some instances where the fruit, particularly pears, received unnecessarily rough treatment. When this occurred, the matter was at once brought under the notice of the foreman, who had the matter rectified without delay. The stevedores, as a body, did the work with reasonable care; the rough handling usually being due to the thoughtlessness of individual workers in the separate gangs.

Careful handling at the ship's side has reduced bruising to a minimum.

It is pleasing to record that many of the refrigerating engineers paid a tribute to the care exercised in loading the ships at Melbourne, and to inspectors for the thorough and able manner in which their duties were carried out.

Merchants' Reports.

The following are extracts from reports received from merchants who handled Victorian fruit during the 1935 season:—

A Covent Garden Merchant.

Plums.—The shipments which we received were packed in half-boxes. No parcel arrived in absolutely sound condition, all showing waste to a more or less degree. In some instances the fruit was unwrapped, and the percentage of waste in this was heavy. It was, of course, hardly to be expected that the fruit would arrive in a satisfactory condition when just put up in a more or less "jumble" pack without carefully wrapping and packing each

fruit. In the green varieties, such as Golden Drops and Greengages, browning of the flesh was noticeable in many of the plums. This appeared to begin from the ends of the fruit. With the blue varieties, such as Grand Dukes and Presidents, browning was not in evidence. We are still of the opinion that one of the chief causes of the waste in the plums is that the package used is unsuitable. It is too deep, permitting of three or four layers of plums being packed one on top of the other. The sheer weight of the plums pressing one against the other, particularly with the shaking about that must occur during transit, lends itself to bruising and resultant waste. We would advise the use of a more shallow package such as is used by shippers in South Africa, where the largest and choicest of the fruit is packed in a single layer with the ample protection afforded by woodwool at the top and bottom of the package. In the case of the smaller plums, these are packed in two layers. It has been found from experience that the South African fruit put up in this way generally reaches destination in satisfactory condition.

Apples.—The packing, grading, and condition generally were satisfactory, and the colour showed an improvement on last season, due no doubt to the elimination of the inferior fruit under the new regulations. We had one of two shipments of Pomme de Neige, but found this was not a popular apple. When the fruit reached us it appeared to be in quite fair condition, but it did not hold up very long, and certainly has nothing like the life of other varieties, such as Jonathans, Cleopatras, &c.

Pears.—Here also shipments were graded and packed satisfactorily, and for the most part arrived in fair condition. There were one or two instances of fruit being over-ripe and showing waste. The shipments we had were practically all packed in the flat bushel box, and comprised both the "Fancy" and "Good" grades. In one parcel of Beurre Bosc there were some pears which were damaged by what looked like an insect bite. The greater part of the pears were still firm and hard, but where the skin had been punctured by the bite, or whatever the damage was, blue mould had set up, and this had developed into a brown spot of decay. It was not confined to one particular place on the pear; in some instances it was round the stem end, others the calyx, whilst in others the damage was around the centre or the bulge of the fruit. We had this particular lot examined by a scientist, and he gave it as his opinion that the damage had started with scab in the orchard, when penicillium entered the scab during the picking and packing, but the spread of the damage was arrested by the fruit being in cool storage on the voyage across. Two small lots of pears were sent across in copper sulphate paper as an experiment. On the same vessels as these were sent there were parcels of similar fruit packed in the usual sulphite paper, for comparison purposes, but we found that both lots arrived in good condition, and there was nothing to choose between them.

A Spitalfields Merchant.

Apples.—We are pleased to note that the shipments have been despatched under two grades, "Extra Fancy" and "Fancy." This is a move in the right direction. Unfortunately, however, we have come across a good deal of the fruit being mixed in both grades, with the consequence that we have had to sell the same exactly on its merits. This, no doubt, is due to the fact that growers are not yet accustomed to the new system, and it is to be hoped, therefore, that the packing practice will become general next year. The colour of dessert varieties, such as Jonathans and Rome Beauties, was noticeably better this season than last, although the Victorian fruit is still a good way behind New Zealand fruit in this respect.

Pears.—Most of the pears have been shipped as "Fancy," while some were sent over under the "Good" grade. Here, again, we think that the two-grade packing for years is an excellent scheme, although we have handled "Good" fruit from some growers which has been as fine as the "Fancy" grade of other packers. We hope, therefore, that here also there will be greater uniformity next season. We have been pleased to notice that many of the unwanted large sizes have been eliminated, but we still think that a uniform embargo could be placed on all unpopular varieties such as Broom Parks, Sheldons, &c., which are particularly unsaleable when the market is comfortably supplied with the better class varieties.

Plums.—During April we handled a consignment of Grand Dukes and Satsumas, which arrived in surprisingly good condition. Both varieties are good travellers, the Grand Dukes being slightly better. We see no reason why earlier shipments should not be tried in future seasons, although doubtless the growers would have to meet the competition of the South African exporters, especially as regards eating varieties. Our shipment was a decided success, however, and prices were very satisfactory.

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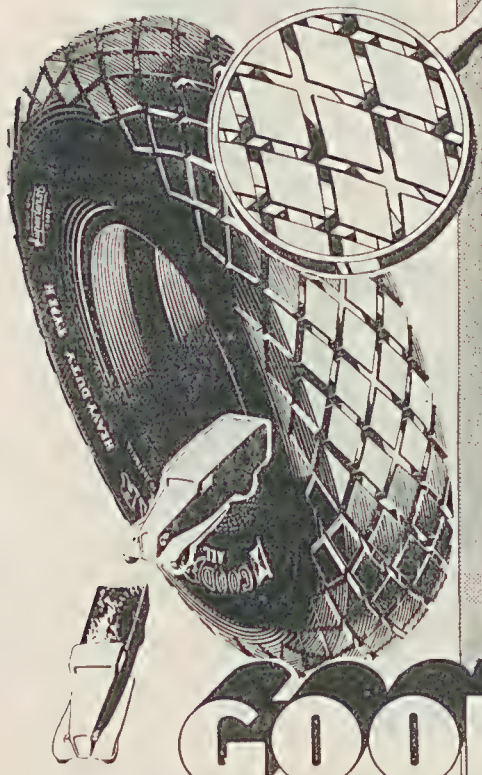

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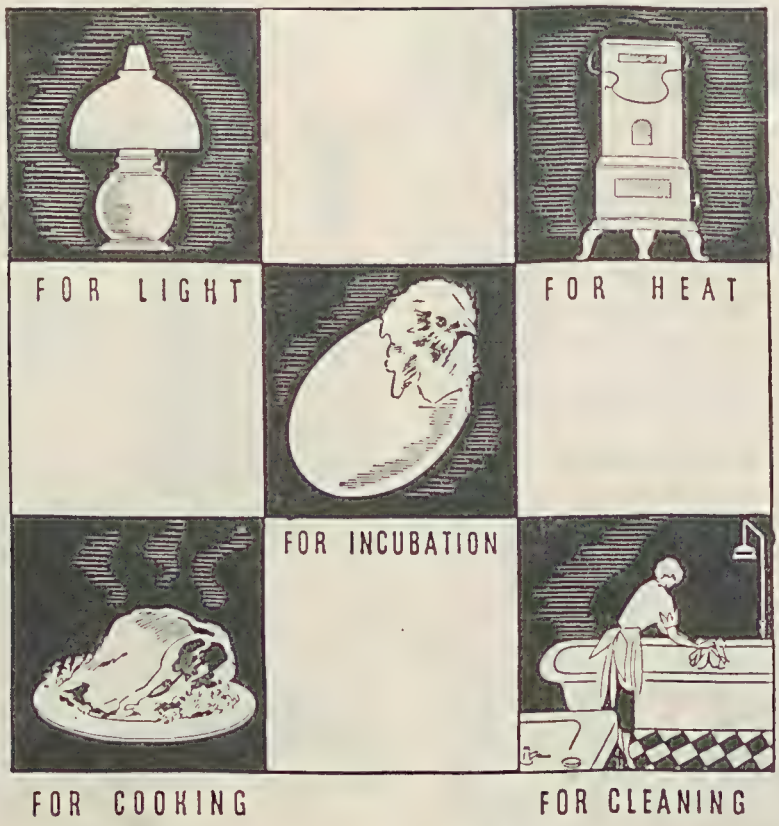

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Another Spitalfields Merchant.

Generally speaking, the appearance and packing of the Victorian apples and pears handled by us during the past season were satisfactory. We considered colour grading to be an improvement, but at the same time there is considerable variation in the colour in each particular grade. Thus, some growers' "Fancy" Jonathans are considerably better coloured than others. Buyers here definitely prefer the Canadian standard box, and we should recommend this, and counts should be stencilled on the ends in preference to the size of the apple in inches.

There has been a certain amount of box bruising in Victorian pears packed in the flat bushel box. We are inclined to the opinion that pears do rather better when packed in the Canadian type white wooden box, and Tasmanians packed in the three-quarter box certainly did very well during the latter part of the season.

An Agent at Spitalfields.

We cannot report any great improvement in the packing of Victorian fruit during the past season, although the progress of the past few seasons appears to be maintained. We feel that it is imperative that one standard container should be used. Our preference, which we have always expressed, is for the Canadian case. We must say this season there has been a far less proportion of unsightly dump cases noticeable in the bulks. We feel that you can be satisfied with results achieved by the adopting of the regulation fixing minimum colour requirements, and we shall be pleased to see these regulations continued, as in previous seasons we have had many parcels of so-called coloured varieties showing very little colour at all, especially in the early shipments. It is hardly necessary for us to point out what the last season made so apparent, that, provided the U.K. markets are not over-supplied, results are very satisfactory. We can only hope that next year the quantities shipped to this country will not exceed by any great number those of the past season, and we can then confidently anticipate satisfactory results, to the mutual benefit of all interested in this business.

A Covent Garden Distributor.

In making comparison between American and Australian packing, we must say that you have yet to make considerable progress before you approach the American standard. The Americans do give what you buy according to grades, and we must certainly say that this season we have seen the Victorian fruit approaching this standard. There is one other thing, the colour regulation had the effect of shortening the exports, and our market, therefore, was never overcrowded at any time of the season, with the result that the growers have received more for their apples that they exported than they have for some years past.

Regarding pears, we think the fruit generally this year was inferior to the last few years, probably due to climatic conditions during the growing period, as we understand that Melbourne experienced very bad floods during that period. We think there is yet a great deal to be done with the grading to pears. They are probably more difficult to grade into "Fancy" and "Extra Fancy" than apples. This year we received one brand of pears, and the probability is that they were procured from different orchards, and our experience with Bosc, for instance, was that we opened one box, and found the pears to be the true brown Bosc that we know here, but when we opened another box, they were different altogether, being green. The result of this was that when the buyers here examined two cases like this, they were not sure about the bulk, and eventually the

(*Continued on page 562.*)

Inspecting fruit at the ship's side.

HAY MAKING & STACK BUILDING

OF the many crops grown in Victoria that can be readily harvested for hay, the most popular are oats, wheat, and lucerne, though the Old World practice of conserving grass and clover mixtures as meadow hay is gaining favour in districts where conditions are suitable.

On any farm good-quality, well-stacked hay is always an insurance against loss during times of scarcity, and represents one of the main assets of the farmer who is associating the keeping of live-stock with cultivation. It is essential, however, that this hay should be grown and harvested as economically as possible, and at a cost that, either when sold or used on the property, it will show a profit to the grower. Experience at the State Research Farm, Werribee, indicates that the main factors that will assist in reducing the cost of production of oaten or shandy hay are—

1. A suitable crop rotation should be practised. Hay is profitably grown at Werribee alternately with fallow or in rotation with barley and bare fallow, such as "fallow–oaten hay–barley" or "fallow–oaten hay–barley–pasture." In districts of heavy rainfall green crops sown alternately with hay and fed off to sheep have proved profitable, particularly if the land to be cropped is ploughed as soon as possible after the green crop has been grazed in the late spring.

2. The seed bed should be well prepared and the seed sown only after weeds have been destroyed.

3. Late April and May are the best seeding months at Werribee. Where hay crops can be fed off profitably, it is advisable to sow early.

4. The seeding rate varies from 1½ to 2½ bushels per acre for wheat or oats. Early sowing requires less seed than late sowing. Rich soils require more seed than poor soils. Land sown with good stooling varieties requires less seed than land sown with poor stooling varieties. A heavy dressing of seed is usual in wet districts, while a light dressing will suffice in areas of poor rainfall. All seed sown should be selected from disease-free crops, and should be sound, plump, and free from weed seeds. Grading is advisable before sowing, and pickling is particularly necessary where wheat is sown.

5. Superphosphate applied with the seed is essential to success. The results of 20 years' experiments at Werribee show that, while Algerian oats sown on fallow without superphosphate have yielded an average of only 18 cwt. per acre, Algerian oats sown on land not fallowed and without manure averaged only 14 cwt. per acre. The same variety sown with 1½ cwt. of superphosphate per acre on fallow land has averaged 2 tons 2 cwts. to the acre. Thus, at a cost of slightly more than 4s. 6d. per acre for superphosphate, more than twice the hay was produced. Applications above 1½ cwt. per acre have proved profitable in districts of heavy rainfall, and further, the residual effect of such dressings is seen in the profitable increase in the growth of the grass which follows the crop. Hay may be grown profitably in districts of heavy rainfall without resorting to the practice of fallowing, but seldom in Victoria without the use of superphosphate.

During the past few years at the State Research Farm, increased yields of oaten and wheaten hay have been harvested from plots

which have not been fallowed before seeding, but which have received a fertilizer dressing of superphosphate and sulphate of ammonia sown with the seed. The most profitable dressing appears to be ½ cwt. of superphosphate and 1 cwt. of sulphate of ammonia per acre, but these tests have been carried out over a period of two years only and further trials will be necessary before definite recommendations along these lines can be made.

When large areas of hay are to be harvested with a minimum plant, harvesting should be started a few days before the bulk of the crop is ready to cut so that the work will be in full swing during the period when the crop is at its best. Oaten hay should have full grain when harvested for hay, while wheaten hay is of best quality if cut before the grain in the head firms to the doughy stage.

Correct stooking is a necessary operation in the production of good quality hay. This operation can follow the binder after an interval of a few hours in bright sunny weather. The stooks should be left in the field for at least three weeks before a start is made at carting and stacking. A practical test of maturity of the hay can be made by taking a handful from the centre of a sheaf inside the stook and firmly twisting it; if the hay thus treated has a dry rattle then carting and stacking can be proceeded with safely until any adverse change in the weather occurs.

Hay growers who intend to conserve their hay for some time should build their stacks on sites that do not interfere with the future tillage of fields. A well-drained area should be selected close to a suitable outlet so that the hay can be removed readily when sold or used on the farm. Haystack building is quite an art and requires considerable practice before anything like a creditable result can be expected. The aim of the stack builder should be to erect a stack in such a way that it will be economical of construction, proof against weather and vermin, and, when completed, present a secure and workmanlike appearance.

Provision should be made for a suitable stack base to prevent waste of the lower layers of hay, as moisture rising from the ground results in loss. A suitable stack bottom could be prepared by the use of stone, wood, or straw, whichever material is easiest to secure and of lowest cost. A practice sometimes adopted is to cultivate the area marked for the stack base before setting the dunnage. This has been shown to prevent moisture lifting. Stack stands protected by a galvanized iron fence 2 feet high are advisable in mouse-infested districts.

Many farmers find it difficult to estimate the quantity of hay they have harvested, and to

Finishing off the stack.

Topping a large stack, using an elevator.

build a stack of the correct dimensions for the amount of hay available. It is necessary to recognize that some hay districts produce a much heavier hay than others, or, in other words, the relation of volume to weight varies considerably. Variety, time of cutting, method of curing, season, climate, district, and soil, all have an influence on this.

A good crop of Algerian oats grown on the clay soil of the Werribee district should yield approximately 2¼ tons to the acre, and each acre of this crop can be tied readily with the binder using one ball of twine of approximately 5 lb. A spool of twine weighing 7 lb. usually ties about 3 tons of hay. If a hay grower counts the number of balls or spools of twine he uses he should be able to calculate fairly accurately the number of tons of hay available for stacking. Knowledge of this kind is the first essential in considering the size of stacks to be built. For example, if 120 tons of good quality Algerian oaten hay is ready for stacking, and it is intended to build the whole into one stack, a suitable base would be 20 yards by 7 yards with rounded ends. This stack, if built 18 feet high to the turn of the eaves, and roofed to a further 12 feet above the eaves, should contain, if well built, approximately 1,200 cubic yards of hay with a weight approximating 120 tons. The following figures should be of interest to farmers who intend to set out a stack base in readiness for stacking:—

Comparisons of Volume to Weight on Well Built Stacks One Week after Stacking.

	cub. yds. per ton.
1. Heavy, short, well filled, solid strawed, clean, oaten hay ..	9 to 10
2. Long, well headed, clean, oaten hay	10 to 11
3. Shandy hay will vary according to season and variety ..	10 to 11
4. Wheaten hay will also vary according to season and variety	11 to 12
5. Oaten hay stacked loose after being cut with a mower ..	12 to 13
6. Pasture or lucerne hay cut with a mower	18 to 20

Stacked hay settles considerably in the stack. Twelve months after the stack is built the volume would be reduced by at least 10 per cent. and in some instances up to 20 per cent. The shrinkage in volume depends upon the class of hay stacked and the height of the stack. Large, high stacks are most suitable for long periods of storage as they present only a comparatively small percentage of their bulk to the weather, and prevent to a large degree the ravages of mice. Small stacks are, of course, necessary at times when the quantity

of hay to be stacked is limited, and also when the farmer needs the product for his own livestock.

If a suitable hayshed is available stacking is simplified. In this case care should be taken to build the hay surface flat so that no excessive side spring will occur as the height of the stack increases. If the stack is to be built in the field or hay yard the builder should see that the surface of the stack is progressively higher in the centre than the edges. The centre fullness should be maintained throughout the stacking operation to ensure suitable side spring and protection generally from damage by rain.

A good supply of well stacked hay is an insurance against unfavorable seasons.

Stacks are built in a great variety of shapes, some of which are not exactly artistic or even what the amateur builder intended, but by the exercise of genuine patience, some experience and hard work, a handy man with a good eye can overcome these irregularities in time and develop into a very creditable stack builder.

Stacks may be built circular, square, or oblong; for small stacks the first two shapes may suit, but for a stack of 60 tons and upwards the oblong shape with circular ends is the most economical and popular. If loose hay is to be stacked square corners are quite suitable, but where sheaves are to be stacked it is easier to round the corners or even the ends. This rounded effect sets the stack off in appearance and is much more readily constructed securely.

A well made and efficiently thatched stack.

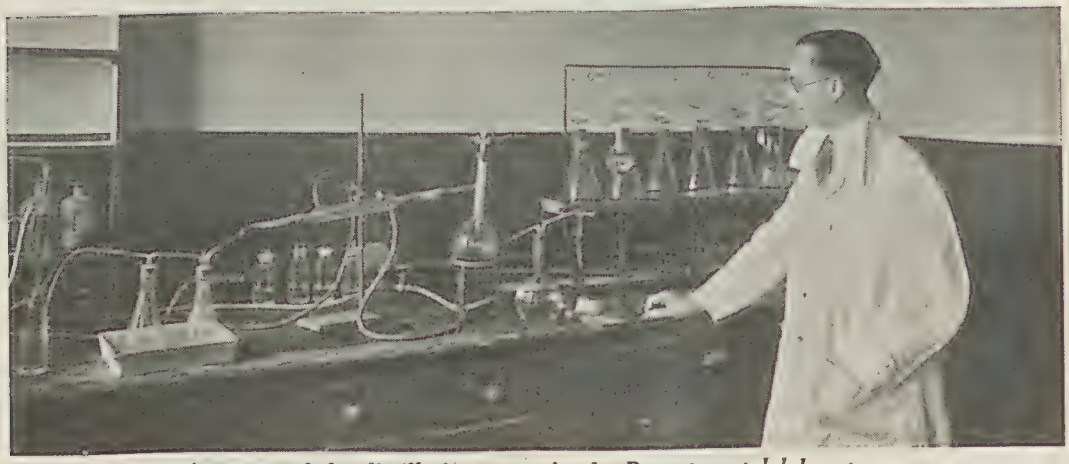
All sheafed hay when stacked at the State Research Farm, Werribee, is placed with butts out and heads covered throughout the stack building operations. The alternative method, which is preferred by some stack builders, is to place the butts of the sheaves out for the outside layer and then bind with heads out to the centre. The ends of the stack need particularly careful binding to the centre of the stack. This will prevent undue springing as the ends usually slip much easier than the sides. Every sheaf needs correct placing and packing to ensure a solid job. The layers of sheaves forming the eaves should overhang the walls by at least 6 inches so that water from the roof is shed readily to the ground without damaging the sides of the stack. The roof of the stack should be built so that when finished it presents an angle of approximately 40 degrees with the outside eaves layer. Every sheaf of the roof should be placed slanting outwards and downwards so that the finished stack is watertight. A good thatch is a final necessity and this should be done a few weeks after the stack is built, as time is necessary to allow the stack to settle; the thatching done after this period should be solid and permanent.

Well-built stacks, adequately protected, are always a pleasant picture on a farm, as well as a security that no farmer can afford to be without.

Lead Arsenates

Analyses of Samples, 1935-36

By W. C. Robertson, Chemist.



A corner of the distillation room in the Departmental laboratory.

USED in fruit-growing countries throughout the world, lead arsenate is perhaps the most important weapon available to the orchardist for the control of insect pests. Until comparatively recently, however, the efficiency of this pest destroyer was, to some extent, uncertain because of the great variability in the chemical and physical composition of the samples offered for sale. Since the passing of the Victorian Fungicides Act, which was designed to protect orchardists from inferior fungicides, there has been a very considerable improvement in the quality of these products. This has been particularly the case with lead arsenates, the standard of which is still being improved. That this is so is evident from a comparison of this year's analyses of commercial lead arsenates with those obtained last year and published in the September, 1934, issue of this *Journal*. Table I. shows the average analyses of the samples for the two seasons, and discloses that the position this year is eminently satisfactory. The complete analyses for the current season are set out in Tables II. and III.

The lead arsenates on the local market are those which are termed "acid" arsenates. The theoretical composition of these compounds is 33.13 per cent. of arsenic oxide combined with 64.29 per cent. of lead oxide, the water of constitution being 2.58 per cent. When, however, the acid lead arsenate is manufactured commercially, the arsenic oxide content varies between 31 and 33 per cent. and the lead oxide between 63 and 65 per cent.

The samples collected for the current season have the following average composition:—Arsenic oxide 31.72 per cent. and lead oxide 63.98 per cent., leaving 4.30 per cent. for the water of constitution and impurities undetermined. These figures, which are calculated on the dry basis, show a marked degree of purity.

TABLE I.—AVERAGE ANALYSIS OF LEAD ARSENATE SAMPLES, 1934-35 AND 1935-36.

Season.	Total Arsenic (on the dry basis).	Water Soluble Arsenic Oxide (on the dry basis).	Amount of Arsenic Oxide in suspension after agitation in water and 5 minutes settling.
	per cent.	per cent.	grms. per gallon.
1934–35	31·80	·38	2·39
1935–36	31·72	·23	3·16

When it is taken into consideration that the value of lead arsenate as an insecticidal spray depends upon (1) the content of arsenic oxide, (2) the percentage of arsenic oxide soluble in water, and (3) the spreading power as portrayed by the suspension test, the figures in Table I., comparing last season's average analysis with that obtained from the samples collected this year, are of particular interest. A great improvement in the quality of some of the brands is disclosed.

The total arsenic (As_2O_5) represents the killing efficiency, while the amount of arsenic soluble in water is a guide to the risk which may be expected from burning. The arsenic in suspension is regarded as a test of the physical condition of the spray material, and denotes its covering power or spread. A glance at the figures in Table I. will show that there is practically no difference in killing efficiency (total arsenic oxide) between the two seasons' samples, but there is a marked decrease (approximately 40 per cent.) in the risk of burning. The covering power of the current season's samples has been improved to the extent of approximately 27 per cent.

As the acid method (i.e., the addition of lead oxide to arsenic acid in the presence of an acid catalyst) is now the one in general use, it would appear that the degree of division of the lead arsenate precipitate is controlled largely by the method of manufacture. This statement is based on the fact that brands of arsenate without the addition of any spreading agent show just as high a suspension figure as those

Calculating results in the analyses of lead arsenates.

brands containing a spreading or wetting agent. In this connexion, acidity and the quality of the water used are known to play an important part. While casein-lime and certain organic spreaders may not be harmful in lead arsenate, the same cannot be said of the casein-soda or alkali soaps.

With the amendment of the *Fungicides Act* 1928 which will come into operation early in 1936 and the proposed new standard for lead arsenates, it is expected that further improvements in the quality of these insecticides will be brought about.

TABLE II.—CHEMICAL ANALYSES OF LEAD ARSENATE.

Brand.	Manufactured in, or Imported from.	Sample as received.			Calculated on dry basis.		
		Moisture.	Arsenic (As_2O_5).	Lead (PbO).	Arsenic (As_2O_5).	Lead (PbO).	Arsenic Water Soluble.
		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Orchard (powder)	U.S.A.	·91	29·76	60·65	30·03	61·20	·21
Arsinette (powder	N.S.W.	·84	31·07	60·83	31·33	61·34	·28
Vallo (paste)	Victoria	47·44	16·16	35·28	30·75	67·12	·17
Unity (powder)	England	·15	32·36	63·87	32·41	63·96	·23
Summit (powder)	Germany ..	·18	30·91	64·41	30·97	64·52	·43
Lion (Paste)	Victoria	57·63	13·82	27·12	32·62	64·02	·17
Swifts (powder)	U.S.A.	·07	32·52	63·97	32·55	64·02	·23
Challenge (powder) ..	.. .. ..	·58	31·43	63·04	31·61	63·40	·23
Bergers (powder)	England	·45	31·04	63·95	31·18	64·24	·23
Bergers (paste)	Australia ..	53·10	15·20	30·02	32·41	64·02	·23
Blue Bell (paste)	Victoria	49·95	16·29	32·05	32·54	64·02	·17
Elephant (paste)	Victoria	51·36	15·83	31·18	32·55	64·10	·17
Acro (paste)	Sth. Aust. ..	50·38	15·60	32·28	31·45	65·06	·23
Acro (powder)	Sth. Aust. ..	·38	31·55	64·41	31 67	64·66	·23

Acidity.

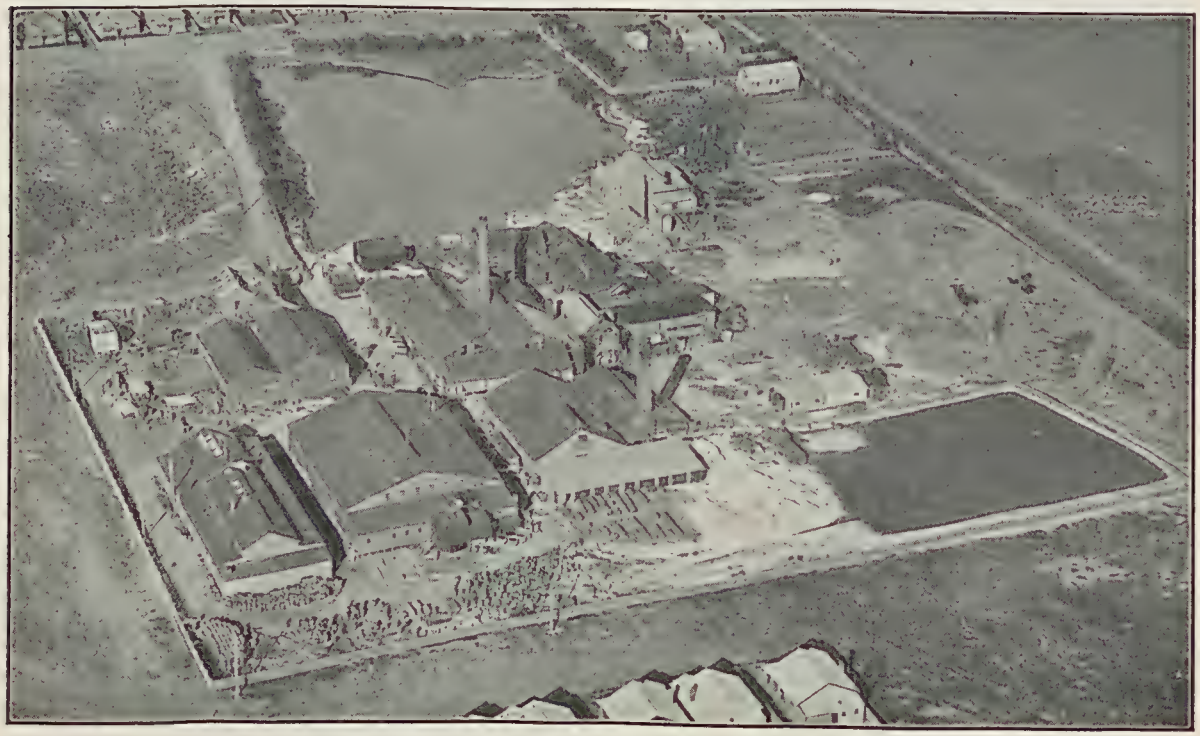
As the question of limiting the acidity of lead arsenate is under consideration, the samples of the various brands on the market this season were analysed for their acid content. The results are given in the last column of Table III. The existing standard which is proclaimed for lead arsenate in Victoria does not limit the acidity, but the English standard provides a limit of 7.5 ccs. of N/100 soda solution to the water extract from 2.5 grms. of dry arsenate; this represents an acidity of approximately 0.19 per cent. calculated as nitric acid.

It will be seen from the figures in Table III. that, of the fourteen samples analysed, only one exceeded this limit, and in this case the acidity exceeds 1 per cent., which is more than five times the limited quantity. The acidity of the arsenate may have an important effect in dual-purpose spraying or in double spraying, as, for example, lead arsenate-Bordeaux or Bordeaux before and after lead arsenate, because of the danger of the formation of soluble compounds which, with inter-reactions, will produce soluble arsenic.

Spray Admixture.

Many inquiries have been received from orchardists and market gardeners on the subject of mixing other spray compounds with lead arsenate for the purpose of dual pest control, and it is considered that a few comments would be of value at this stage. Ordinary lead arsenate, because of its acid character, is more liable to chemical change than basic lead arsenate. The latter compound is used in the United States of America in spray admixture, but is not on the local market. It may be manufactured by (1) treating basic lead acetate with arsenic acid; (2) by causing sodium arsenate to react with litharge (lead oxide) and nitric acid; or (3) by adding ammonia to the acid lead arsenate. It has the following theoretical composition:—Arsenic oxide (As_2O_5), 23.2 per cent.; lead oxide, 75 per cent.; water of constitution, 1.8 per cent. Owing to the lower percentage of arsenic, the basic salt is inferior in killing efficiency to the ordinary acid arsenate.

While a detailed discussion on the chemical changes which take place when lead arsenate in either form is mixed with other pest destroyers



An aerial view of a Victorian Lead Arsenate works.

TABLE III.—SUSPENSION TEST, DEGREE OF FINENESS.

Brand.	Percentage of Arsenate remaining in suspension after standing.		Grams of Arsenic (As_2O_5) per gallon in suspension five minutes after agitation.	Acidity: Ccs. of $\frac{N}{100}$ Soda per 2·5 grms.
	Five Minutes.	Thirty Minutes.		
	per cent.	per cent.	grams.	
Orchard (powder)	71·2	13·92	2·41	42·0
Arsinette (powder)	86·8	52·20	3·06	5·3
Vallo (paste)	96·3	83·50	3·54	1·2
Unity (powder)	74·2	24·36	2·72	5·0
Summit (powder)	98·4	80·04	3·23	5·0
Lion (paste)	88·0	85·61	2·73	1·3
Swifts (powder)	95·9	75·18	3·53	1·5
Challenge (powder)	84·2	73·10	3·00	1·4
Bergers (powder)	94·7	69·60	3·34	1·8
Bergers (paste)	86·8	80·76	3·00	1·2
Blue Bell (paste)	90·8	87·00	3·36	1·0
Elephant (paste)	98·5	87·00	3·54	1·1
Aero (paste)	92·3	83·50	3·27	3·0
Aero (powder)	97·8	80·04	3·47	2·0

is not being attempted in this article, the following salient facts are given as a guide to growers contemplating the admixture of lead arsenate with lime sulphur, dry-mix sulphur, atomic sulphur, Bordeaux mixture, white oil, or nicotine sulphate.

Lead Arsenate (Ordinary) with Liquid Lime Sulphur.—This admixture is accompanied by chemical changes which (*a*) reduce the polysulphide and soluble sulphur percentage; (*b*) increase the soluble arsenic content; and (*c*) produce minor quantities of other soluble compounds which may have deleterious properties. In effect, the admixture of these two spray compounds reduces the efficiency of the lime sulphur and, at the same time, produces a greater risk of damage from burning. The addition of chemical lime lessens the possibility of injury.

The use of basic lead arsenate in lieu of the ordinary arsenate is held by some investigators to be advantageous, the reactions being definitely retarded in this case, with a pronounced decrease in the amount of arsenic rendered soluble.

Calcium arsenate may be mixed with concentrated liquid lime-sulphur in the presence of free lime without any harmful chemical change. However, the existing disadvantages of calcium arsenate—i.e., its low covering power and comparatively large amount of soluble arsenic—remain unaltered.

Dry-mix lime-sulphur and atomic sulphur may be mixed in all proportions with lead arsenate without fear of any deterioration.

Acid Lead Arsenate with Bordeaux Mixture.—These spray compounds do not undergo any harmful chemical change when mixed, providing the Bordeaux mixture is prepared properly and is lime alkaline.

Acid Lead Arsenate with White Oil.—This mixture is in common use in Victoria, and it is interesting to note that white oil, which is distinctly ammoniacal, may convert the acid salt into the basic compound; otherwise the admixture would not be accompanied by chemical change.

Lead Arsenate with Nicotine Sulphate.—The above pest destroyers are compatible, and may be mixed in the proportions recommended without alteration in the efficiency of either spray. This is not the case, however, with calcium arsenate, which reacts with the nicotine sulphate to produce soluble arsenic.

While the admixture of pest destroyers, having for its objective a dual-purpose spray to lessen the cost of production, is very often wrong in theory owing to the chemical changes which take place, in practice it often proves satisfactory. One example is the common practice, in vogue in the United States of America, of mixing lead arsenate and liquid lime sulphur—a mixture which is known to result in double decomposition, with a proportionate loss in the polysulphide content of the lime sulphur. It would appear that climatic conditions play an important part, and, in all probability, this is the main reason why this admixture has proved unsuitable for Victorian conditions.

Tobacco Investigations (II.)

Results of Experimental Work, 1934-35

By W. J. B. McDonald, B.Agr.Sc., Inspector of Agriculture

The results of the experiments at Myrtleford, South Pomonal, and Stockdale were published in the October issue of this Journal.

AS indicated in the first section of this report, which appeared in the previous issue of the *Journal of Agriculture*, tobacco seedling nurseries were established in Victoria during the past season in areas exhibiting widely differing climatic conditions. This was done in an endeavour to determine whether any portion of the State exhibited features which would prevent the development of Blue Mould (*Peronospora tabacina*).

These nurseries were located at Werrimull, in the extreme north-west Mallee; Walpeup, on the Ouyen-Murrayville line; Shepparton, Mount Major (Dookie College property); Stockdale, in North Gippsland; Badger's Creek, in the Healesville district; Beech Forest; and at French Island, in Western Port Bay. With the exception of the nurseries at Shepparton and Stockdale, all seed-beds were planted on ground virgin to tobacco, and in areas many miles distant from any other tobacco seedling nursery. With the exception of those at French Island, which were destroyed by the December floods of last year, all seed beds eventually developed disease in some form or other, although attacks at Walpeup and Stockdale were not sufficiently severe to seriously affect the plants until late in the season, when the Stockdale beds became badly affected.

In the season under consideration, October was a particularly wet and humid month, ideal for disease development. This was a rather abnormal feature as far as Walpeup and Werrimull were concerned.

A brief summary descriptive of the seed beds at each centre is appended, with a somewhat fuller discussion of the seed beds established at Shepparton.

Werrimull.

Soil.—Red Mallee sand; typical Murray pine ridge.

Varieties Sown.—Big Oronoco, Warne, Hickory Pryor, and Gold-leaf.

Seed.—Imported American, sown on 10th July, 1934.

Growth.—Slow, considering temperature, probably due to lack of soil moisture during September.

Disease.—Officially observed on 30th October, 1934. Probably present at least one week earlier.

Meteorological Data.	September.	October.
Average minimum temperature	45·6° F.	50·1° F.
Average maximum temperature	69·7° F.	77·3° F.
Average humidity at 9 a.m. ..	66%	58%
Rainfall	59 points	294 points

Walpeup.

Soil.—Similar to that at Werrimull.

Varieties Sown.—Hickory Pryor, Warne, Gold-leaf, White Stem Oronoco, Big Oronoco, Yellow Oronoco, Little Oronoco, Conqueror, Adcock, Long-leaf-Gooch, Flannagan, Yellow Pryor, Crutcher, Lizard-tail, Hester, Cash.

Seed.—Imported American, sown on 19th July, 1934.

Weather.—October wet and humid, as was experienced at Werrimull. Temperature and humidity records are not available, but they would be very similar to those given for Werrimull.

Rainfall.—September, 128 points; October, 376 points.

Disease was first observed as very light and indefinite; leaf lesions on the variety Hester on 29th October, 1934. At no stage did the plants show signs of succumbing to the disease, although later in the season the infection became more marked.

Mount Major.

Elevation.—1,251 feet.

Soil.—Red clay loam, shallow, and rather difficult to work.

Varieties Sown.—Warne, Hickory Pryor, and Gold-leaf.

Seed.—Imported American, sown on 25th July, 1934.

Growth.—Germination very slow, but subsequent growth fair.

Weather.—Dry winter and early spring, with a wet October.

	September	October
Average minimum temperature ..	41·8°F ..	45·1°F
Average maximum temperature..	62·3°F ..	67·0°F
Rainfall	136 pts. ..	486 pts.

Disease.—Officially observed as present on all varieties on 12th November, 1934. First infection probably produced spores early in November.

Badger's Creek (Healesville).

Soil.—Grey sandy loam.

Varieties Sown.—Warne, and Gold-leaf.

Seed.—Imported American, sown on 5th September, 1934.

Growth.—Germination good, and subsequent growth fairly rapid.

Disease.—Officially observed to be present on 16th December, 1934, but probably occurred about 9th December, 1934. Beds were destroyed by disease.

French Island.

Beds destroyed by flood waters in December.

Stockdale.

Soil.—Grey sandy loam, naturally carrying big timber. Site had previously grown seedlings.

Varieties Sown.—Conqueror, Hickory Pryor, Dungowan Seln., Gold-leaf, Warne, Cash, Adcock, and Hester.

Seed.—Some imported seed and some local; sown on 7th August, 1934, and 21st August, 1934.

Growth.—Germination poor, subsequent growth good.

Weather.—September fairly dry; October and November wet.

Rainfall.—September, 121 points; October, 345 points; November, 390 points.

Disease occurred in later sown beds on 24th November, 1934. The bulk of the seedlings grown were planted out successfully.

Beech Forest.

Elevation.—2,000 feet.

Soil.—Rich black crumbly loam, with a very acid soil reaction.

Varieties Sown.—Warne, Gold-leaf, and Hickory Pryor.

Seed.—Imported American, sown on 11th September, 1934.

Growth.—Germination very slow, and subsequent growth very slow, although beds were framed and covered with hessian.

Weather.—Very cold and wet, with exceedingly high humidity. The highest average weekly temperature recorded for any week prior to that commencing on 10th December, was 54° F. The average temperature for the week, 10th December to 17th December, was 58° F.

For a period of 842 hours out of a total of 1,500, prior to 24th December, the average humidity exceeded 80 per cent., while it dropped to below 60 per cent. for a period of only 147 hours out of 1,500.

Rainfall.—October, 819 points; November, 755 points; December, 523 points.

Disease.—Blue mould was present definitely on 24th December, 1934, and subsequently became severe. It will be observed that this outbreak followed closely on the warmest week experienced up to that date.

. . . . .

From observations carried out at these widely separated seed-bed areas it can be confidently stated that, in those parts of Victoria capable of growing tobacco seedlings, blue mould is likely to develop in some seasons. It also is fairly evident that there is a definite time lag between the appearance of the disease in northern and southern districts. The purchase of additional meteorological recording apparatus will enable comprehensive data, such as that obtained at Beech Forest, to be tabulated at five different stations during the present season. It is hoped eventually to be able to correlate the appearance of blue mould with certain weather conditions.

Shepparton Seed Beds.

At Shepparton, a comprehensive scheme of seed-bed investigations was established on good red sandy loam, which previously had grown seedlings which had developed disease. This work had as its objective the discovery of information relative to the following points:—(*a*) Variations in varietal resistance to mould in the seed bed; (*b*) The efficacy of various spray treatments and (*c*) The value attaching to different modes of seed-bed management.

Varietal Resistance.

Under conditions similar to those experienced at Shepparton last spring, the early growth of all seedlings was satisfactory without the aid of any artificial watering. The first outbreak of mould was observed in the variety Dungowan, on 8th October, and was followed closely by outbreaks in all other varieties. Up to the present time there is no observable difference in the susceptibility of popular varieties to disease attacks in the seed bed. Lack of resistance to mould in the seed bed should not be confused with any subsequent resistance that may be evident in the field.

Spray Treatments.

In the season just past, neither lime-sulphur, Bordeaux mixture 4-4-40, colloidal copper, or copper emulsion applied as sprays prevented the development of mould. The dates at which mould was observed in this series of tests are shown in Table I.

An extension of this work is being continued during the present season with an increased staff and better equipment.

Table I.—Appearance of Mould in Seed Bed Trials at Shepparton.

Spray Treatment.	Date of Germination of Seed.	First Spraying.	Appearance of Disease.
Lime-sulphur—			
Applied every 2 days	2·9·34	24·9·34	29·10·34
Applied every 4 days	14·9·34	„	„
Applied every 6 days	4·9·34	„	30·10·34
Applied weekly ..	14·9·34	„	29·10·34
Bordeaux mixture—			
Applied every 2 days	14·9·34	24·9·34	26·10·34
Applied every 4 days	4·9·34	„	21·10·34
Applied every 6 days	12·9·34	„	„
Applied weekly ..	4·9·34	„	29·10·34
Colloidal copper—			
Every 2 days ..	11·9·34	11·9·34	29·10·34
Every 4 days ..	2·9·34	„	25·10·34
Every 6 days ..	29·8·34	„	8·10·34
Weekly	25·8·34	„	9·10·34
Colloidal copper sprayed as thought necessary	30·8·34	25.9.34	24·10·34
Bordeaux 4.4.40 sprayed as thought necessary	„	„	29·10.04
Copper emulsion sprayed as thought necessary	„	„	29·10·34
Lime sulphur sprayed as thought necessary	„	„	24·10·34

Seed Bed Management.

Covering of the seed beds with hessian hastens germination slightly at Shepparton, and in an ordinary season minimizes the amount of watering required. It is very doubtful, however, whether the cost of the material required is justified in northern seed-bed areas, except where wind protection is an important consideration, as it would be in parts of the Mallee. In colder districts, seed-bed covering probably is warranted, as artificial stimulation is necessary to the production of early seedlings.

Table II.—Fertilizer Tests—Shepparton, 1934-35.
(Planted 21st November, 1934, with Hickory Pryor.)

Treatment (per Acre).	Yield of Cured Leaf per Acre.	Percentage of Leaf in each Grade.					Percentage of Leaf Picked on Dates Indicated.		
		Bright.	Mahogany.	Dark.	Immature.	Scrap.	8th April, 1935.	15th April, 1935.	29th April, 1935.
	lb.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
No manure	816	11·5	41·0	27·2	12·5	8·3	13·2	52·7	34·1
Super., 3 cwt.	792	14·4	39·4	19·6	18·2	8·1	38·2	33·4	28·5
Super., 5 cwt.	776	15·5	42·0	22·4	14·4	6·3	25·0	45·3	29·6
Super., 7 cwt.	856	16·8	40·4	20·1	15·2	7·5	23·8	48·0	28·1
Super. 5 cwt., dried blood 150 lb.	824	14·8	39·9	23·8	13·6	8·3	23·3	51·4	22·3
Super. 5 cwt., pot. sulph. 150 lb.	908	11·7	42·8	23·4	16·3	5·7	22·2	56·0	21·8
Super. 5 cwt. + pot. suplh. 150 lb. + dried blood 150 lb. ..	804	17·9	40·8	23·4	11·8	6·7	24·1	59·0	16·9

Following the success of Mr. May, at Bathurst, in using what has become known as the Bathurst type seed bed for raising of tobacco seedlings, two frames of this type were constructed at Shepparton, and a soil temperature in excess of 45° F. maintained. Disease occurred on 12th November, 1934.

Tobacco experimental plots in the Shepparton district.

An attempt was made to grow seedlings under an elevated cover so the amount of water applied could be regulated. This test was nullified by seepage of water through the soil, so it is being repeated this year in a seed bed built on a platform above ground level.

One series of beds which had developed mould was scorched back to ground level by firing old strips of hessian laid flat over the beds. These beds came away nicely again, but later developed a fresh outbreak of mould following unfavorable weather.

A further series of mouldy beds were sprayed with petrol and fired immediately. No further growth occurred on this occasion. The practice is not to be recommended, as it is rather dangerous.

Summarizing the results from the Shepparton seed beds during 1934, it can be stated that no seed-bed technique evolved up to that period will satisfactorily control or combat the disease, blue mould.

Field Experiments—Shepparton.

The field experiments carried out at Shepparton in 1934 were established in a red sandy loam field which, prior to breaking up in 1932, had carried a dense irrigated pasture of paspalum and couch grass, together with an admixture of clovers.

A complete series of fertilizer trials was established in this field, but, owing to unavoidable late planting, severe outbreaks of disease, and a serious delay in maturity, the results as expressed by the cured leaf were rather disappointing. The results obtained from each treatment are summarized in Tables II. to IV., but the figures used in compiling this summary were not sufficiently consistent to allow the results to be regarded as completely significant.

From Table I., it will be observed that the application of a complete manure, as represented by 5 cwt. superphosphate + 150 lb of dried blood + 150 lb. of sulphate of potash has not depreciated the colour grade to any extent. The addition of 150 lb. of sulphate of potash alone to 5 cwt. of superphosphate seems to have depressed the colour grade to a certain extent, but improved the yield slightly. The results obtained from the use of potash at the different experimental stations have been rather contradictory, and indicate that more complete investigations must be made with this particular material. It is possible that potash

TABLE III.—FERTILIZER TESTS, PHOSPHATE AND NITROGEN—SHEPPARTON, 1934-35.
(Planted 20th November, 1934, with Hickory Pryor.)

Treatment (per Acre).	Yield of Cured Leaf per Acre.	Percentage of Leaf in each Grade.					Percentage of Leaf Picked on Dates Indicated.		
		Bright.	Mahogany.	Dark.	Immature.	Scrap.	8th April, 1935.	15th April, 1935.	29th April 1935.
	lb.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Super., 5 cwt.	590	4·7	43·0	20·6	21·0	10·5	..	82	18
3 : 1 mixture (600 lb.) ..	482	2·9	42·3	24·8	19·9	9·6	..	65	35
6 : 1 mixture (523 lb.) ..	618	9·1	37·8	23·0	19·7	10·7	..	68	32
No manure	486	3·3	34·6	19·3	33·8	8·7	..	62	38

TABLE IV.—FERTILIZER TESTS, NITROGEN—SHEPPARTON, 1934-35.
(Planted 20th November, 1934, with Hickory Pryor.)

Treatment (per Acre).	Yield of Cured Leaf per Acre.	Percentage of Leaf in each Grade.					Percentage of Leaf Picked on Dates Indicated.		
		Bright.	Mahogany.	Dark.	Immature.	Scrap.	8th April, 1935.	15th April, 1935.	29th April, 1935.
	lb.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Sod. nitrate, 150 lb. per acre ..	846	2·1	23·6	28·9	34·3	11·1	..	35·7	64·3
Am. sulph., 100 lb.	704	0·3	24·4	31·8	33·8	9·7	..	44·3	55·7
Dried blood, 300 lb.	872	3·2	30·0	28·4	27·2	11·0	..	51·5	48·5
Castor meal, 450 lb.	772	1·5	17·9	24·6	45·0	10·9	..	38·9	61·1
Am. sulph. 33 lb. + dried blood 100 lb. + castor meal 150 lb.	864	3·9	29·4	30·6	24·6	11·3	..	46·3	53·7
No manure	788	2·3	29·0	27·7	28·2	12·7	..	49·2	50·8

will become a valuable fertilizer on ground that has been producing heavily for a number of years, either pasture or some other type of crop.

Superphosphate at the rate of 7 cwt. per acre has not had the depressing effect on yield that has been experienced on previous occasions with dressings of 5 cwt. and 3 cwt. when growing on somewhat higher country. It is suggested that the amount of superphosphate that can be used satisfactorily by the plant is closely related to the soil type, but until further data has been obtained Shepparton growers are advised to use not more than 5 cwt. of this particular fertilizer per acre.

From the results of trials in which nitrogen alone was applied, dried blood appears to be one of the most satisfactory forms in which to make the application, but it is considered that nitrogen should be applied only as a supplement to superphosphate.

Results at Markwood, 1934-35.

A series of fertilizer trials was planted on Mr. Harold Wellington's property at Markwood on 9th November, 1934, with seedlings of the Conqueror variety, grown at Stockdale, in Gippsland. The seedlings which were clean when planted struck well, and remained fairly free from mould right throughout the season. There was a slight attack of spot mould on the lower leaves early in February, but very little damage occurred from this cause.

The stand obtained was a particularly attractive one, and as the plants were of a uniform and attractive type, the bulk of them were allowed to set seed. All of the Conqueror seed distributed by the Department this year came from this particular plot.

The fact that most of the seed heads were allowed to remain on the plant delayed maturity considerably, and had an influence on the results obtained from the cured leaf, but as the seed question in Victoria has become fairly acute, it was considered that this procedure was fully justified.

The soil on the experimental area was grey Ovens river flat, fairly typical of much of the tobacco ground in the Markwood district. It could be described best as a grey silty loam. The sub-soil formation on this property is interesting, and probably has a marked influence on its suitability for tobacco. At a depth of approximately 12 inches the surface loam runs into a sandy strata, which may or may not overlie coarse gravel. A tobacco soil generally is conceived as a sandy surface soil overlying a somewhat stiffer sub-soil, but in view of the results obtained on the Markwood experimental area, it would appear that this soil is an equally satisfactory one, although of a reverse type.

The leaf from the plots was harvested in three pickings, the last being taken on 3rd April, 1935. Leaf taken in this pick suffered somewhat from frosts which occurred on the 25th and 26th March, and did not cure as well as was expected. As pointed out previously, the maturity of the plots was delayed by allowing the plants to retain their seed-heads. A fair proportion of leaf which, when graded, was classed as immature will have reached by this time a saleable condition.

Table V. shows the percentage of leaf occurring in each grade, and also the percentages of the whole which were picked on the dates indicated. The grades labelled Immature Bright, and Immature Mahogany contain leaf

which, on further maturation, would be worthy representatives of the Bright and Mahogany grades respectively.

Considering the results from the fertilizer tests, it will be seen that there is not a great variation in total yield. Five of the treatments, including the unmanured plot, approximate 1,100 lb. per acre, while those plots treated with 5 cwt. of superphosphate and with 5 cwt. of superphosphate + 150 lb. of dried blood, + 150 lb. of sulphate of potash yielded approximately 1,250 lb. of cured leaf per acre. On a yield basis alone, 5 cwt. of superphosphate per acre would appear to be the most profitable dressing to apply, but even without any fertilizers, heavy yielding crops are obtainable at Markwood.

When considering the effect on the cured leaf, differences become more marked. Phosphates generally seemed to have raised the colour grade somewhat, and to have reduced the proportion of immature leaf. The plot dressed with 5 cwt. of superphosphate only, shows the highest percentage of bright leaf, but rather inconsistently shows also a higher percentage of dark leaf. This may be due to some of the bottom leaf having become somewhat over-ripe. The other heavy yielding plot, fertilized with a complete mixture, shows also a relatively high percentage of bright leaf, but a lesser percentage of dark leaf than that obtained from the plot dressed with 5 cwt. of superphosphate.

At Markwood, the introduction of nitrogen in the form of dried blood appears to have delayed the maturity of the crop without improving the yield. Where potash accompanies the phosphate and nitrogen, this delay in maturity has not occurred.

It would seem that at Markwood, potash and nitrogen function best if used in combination, but at the moment it is doubtful whether any fertilizers other than phosphatic ones are warranted. On results obtained up to date, it is suggested that superphosphate applied at the rate of approximately 5 cwt. per acre would prove the most economical fertilizer dressing.

TABLE V.—FERTILIZER TESTS—MARKWOOD 1934-35.

Treatment.	Yield Cured Leaf per Acre.	Bright.	M1.	M2.	M3.	Immature Bright.	Immature Mahogany.	Dark.	Green.	Percentage Picked on—		
										28th February, 1935.	4th March, 1935.	3rd April, 1935.
	lb.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
No manure	1,095	10	4·6	7·2	17·9	6·2	26·2	25·6	2·6	13·7	28·1	58·1
Super. 3 cwt. per acre ..	1,107	12·6	14·1	19·6	10·8	6·5	8·7	26·2	2·2	12·7	22·2	65·4
Super. 5 cwt. per acre ..	1,251	22·5	3·1	11·5	16·2	5·2	6·2	33·4	2·1	18·0	25·6	56·4
Super. 7 cwt. per acre ..	1,134	13·5	9·5	20·3	20·3	6·8	12·3	13·5	4·0	18·5	30·5	51·2
Super. 5 cwt. + 150 lb. dried blood	1,100	11·9	7·1	13·1	22·6	9·5	16·7	16·7	2·4	13·8	26·2	60·0
Super. 5 cwt. + 150 lb. sulphate of potash	1,159	15·2	3·1	3·1	11·1	4·8	22·2	35·0	6·4	17·5	34·8	48·0
Super. 5 cwt. + 150 lb. dried blood + 150 lb. sulphate of potash	1,255	20·8	5·0	13·9	16·7	2·8	11·7	16·7	12·5	16·6	34·6	49·0

Common Parasites of Cattle

By T. L Furness, B.V.Sc., Veterinary Officer.

TO a large extent the control of internal parasites of cattle has been neglected in Victoria. This, no doubt, is attributable to the fact that mortalities due to worms are relatively uncommon in these animals. It is undoubtedly true, however, that the infestation of cattle, especially young stock, with parasites may result in serious economic wastage, the value of which would be difficult to assess. Interference with nutrition, accompanied by a lack of growth and development, and, in adult cattle, by digestive disturbances with loss of condition, frequently are the result of parasitism of the alimentary tract. In a number of instances, suitable treatment and the adoption of rational hygienic measures may prevent, to a large extent, the ravages of worms in cattle.

Twisted Wire Worm, or Round Stomach Worm.

The twisted wire worm, or round stomach worm, which is also a parasite of sheep, is the largest of stomach worms affecting cattle, and is found in the fourth stomach, although, in cases of heavy infestation, it may be found in the first portion of the small intestine also. It is a thin thread-like worm ½ to 1½ inches long, and the females are characterized by red and white striping of the body, giving it a twisted "barber's pole" appearance. This is due to the curling of the white ovarian tubes around the blood-filled intestinal tract. Although not as common here as in the northern States of the Commonwealth, infestation with this worm has caused acute parasitic gastritis amongst young cattle.

Short Hair Worms or Trichostrongyles.

This group includes numerous varieties of small hair-like worms which are very difficult to see without a magnifying glass. They are found in both the fourth stomach and intestinal tract, and when present in large numbers give rise to a condition known as Trichostrongylosis.

Life History.

The stomach and small intestinal worms of cattle have similar life histories. Each female deposits thousands of eggs, which pass out in the animal's faeces, and under suitable conditions of warmth and moisture the eggs hatch out within a few hours, but in cold weather this may be delayed for days. The small embryos, after feeding for three or four days upon the faeces,

Stomach Worm.
A.—Male. B.—Female. C.—Egg.

undergo certain changes, and then ascend blades of grass, and are ingested by grazing cattle. This stage is an extremely resistant one, and, under favorable conditions of heat and dryness, worm larvae may survive on pastures for upwards of ten months, although long periods of drought and extreme cold markedly shorten the period of survival.

After passing to the stomach or intestines, the larvae bore into the mucous membrane. They grow rapidly, and become mature within three weeks after the larvae are ingested.

Effect and Symptoms.

While there are certain general symptoms exhibited by all worm-infested cattle, experience has shown that it is often possible to differentiate between infestation with the twisted wire worm and with trichostrongyles. Infestation with the former has been called haemonchosis, the chief symptom of which is anaemia. This is shown by paleness of the mucous membrane of the eyes, mouth, and vagina, dropsical swelling between the lower jaws (bottle jaw), loss of condition and depraved appetite. Scouring is not a regular feature.

Haemonchosis affects young and old cattle alike, mainly in the late spring, summer, and autumn. Young cattle, if heavily infested, may succumb while still in good condition. The stomach worm is an avid blood sucker, and the anaemia which is a characteristic symptom of haemonchosis is directly due to the abstraction of blood from the lining of the stomach.

Trichostrongylosis mainly affects young cattle from weaning up to about two years of age. Older cattle have a natural resistance to these worms, but if grazed on heavily worm-infested pastures at times when the pasture has lost much of its nourishment, trichostrongylosis may develop.

In young cattle the most marked symptoms are stunting of growth and scouring. Quite often only certain individuals in a herd of young stock show evidence of this disease, and, in addition to being underdeveloped, they present a dejected appearance, while the faeces are greenish black, liquid, and offensive. Symptoms of anaemia may not be apparent for some time, and bottling under the jaw is rarely seen. When scouring develops, condition is lost rapidly, although affected animals may linger for weeks in an emaciated condition before succumbing.

Treatment.

As with sheep, treatment consists of drenching with a solution of copper sulphate (bluestone) and nicotine sulphate (blackleaf 40). To mix this drench proceed as follows:—In three gallons of rain water, dissolve 8 ounces of powdered copper sulphate. Later add 8 ounces of nicotine sulphate. Owing to the corrosive nature of copper sulphate solution, this should be done, preferably, in an enamel bucket. It is advisable to warm the water and powder the bluestone to accelerate solution, and the bluestone should be thoroughly dissolved before the nicotine is added.

This quantity is sufficient to drench 60 yearling cattle, each with a dose of 8 ounces. The dose required varies with the age of the animal, but the following are regarded as satisfactory:—Calf, aged 4 months, 3 ounces; 6 months, 4 ounces; 9 months, 6 ounces; 12 months, 8 ounces; and mature cattle, 10 ounces. Starvation prior to drenching is unnecessary.

On grossly contaminated pastures cattle will rapidly become reinfested, and for this reason one treatment is not sufficient. Drenching should be repeated three times at intervals of 14 days. Wormy cattle should be given a supplementary ration of concentrates.

The Nodular Worm.

The nodular worm (*Oesoph agostomum radiatum*), is a short thread-like worm found in the large intestine. During a certain stage in its development it invades the bowel wall and causes the formation of small rounded nodules. It is due to this, that the condition of nodular disease has become universally known as "pimply" or "knotty gut."

Nodules formed in the intestine as a result of activity of the nodular worm.

The adult worms are white in colour, and vary from ½ to ¾ of an inch in length. Infestation with this parasite is known as Oesophagostomiasis and has a wide distribution in Victoria, particularly in areas of natural high rainfall, and where irrigation is practised.

Life Cycle.

The life cycle of the nodular worm resembles closely that of the worms previously described, up to the stage when the larvae become encysted on the pasture. When swallowed, the larvae pass with the food to the small intestine, from which they migrate into the bowel wall, causing nodule formations. In these nodules, they undergo development and return to the bowel after a variable period of 15 to 150 days, reaching maturity in a few days. Migrating larvae may lodge in other portions of the digestive tract and in the liver, intestinal lymph glands, and omentum or caul. In these latter cases the larvae die.

Effects and Symptoms.

The presence of the larvae in the intestinal wall gives rise to inflammatory changes which result in nodule formations. These vary in size from that of a pin's head to that of a pea, and contain varying quantities of whitish or greenish pus. After development the larvae escape and the small rupture of the bowel wall heals. Old nodules frequently are cheesy in consistency or even gritty, due to the deposition of lime salts. Owing to the presence of nodulation, normal digestive processes are greatly interfered with.

The common symptoms of nodular disease are wasting and diarrhoea. In very acute cases the animal may walk with a stiff stilted gait, particularly in the hind limbs.

Treatment.

There is no satisfactory treatment for this disease in cattle. The nodules cannot be reached with drugs and owing to the site favoured by the adult parasites, i.e., the large intestine, adult worms are difficult to deal with. Drenching as prescribed for trichostrongylosis has been followed by some improvement.

Lungworm.

The large thread lungworm (*Dictyocaulus filaria*) inhabits the large air passages (bronchi) in the lungs of cattle. It is only in young cattle, from weaning age to about 18 months, that lungworm has proved troublesome.

The adult worms are white in colour, and thread-like, measuring 1 to 4 inches in length. They are found lying coiled in tangled masses, mixed with mucus, in the terminations of the air passages, although in heavy infestations they actually may be found in the windpipe.

Lungworm disease is common in low-lying, marshy districts of high rainfall, and in areas subject to inundation. Usually it appears at a time when the nutritive value of natural pasture is at its lowest, i.e., during autumn. It may continue, however, through the winter and early spring.

Life Cycle.

The eggs of the lungworm are laid in the bronchi, and are usually coughed up and swallowed. They hatch in the bowel, and the embryos pass out with the faeces. After feeding for about eight days, they migrate into the grass and become encysted, in which state they are ingested by grazing animals. The larvae bore through the wall of the intestine into blood vessels, and are carried to the lungs in the blood. Five to seven weeks later, mature adult worms are found in the bronchi.

Tangled masses of lungworms appear in the terminations of the air passages..

Effects and Symptoms.

In the majority of cases, six to eight weeks elapse between ingestion of the larvae and the appearance of symptoms, although the period varies according to the intensity of infestation, to the resistance of the host, and to the nutritive value of the fodder.

The disease develops as an insidious bronchitis, which may gradually develop into a pneumonia. In an affected herd, one first notices an odd animal coughing at long intervals, especially following exertion. In the early stages, the cough is short and dry, but later, often is accompanied by the discharge of much mucus from the nostrils or mouth. This mucus discharge contains ova and embryos, and frequently is swallowed when coughed into the mouth, the eggs being passed later in the faeces.

As the disease progresses, affected animals exhibit the symptoms associated with parasitism, e.g., emaciation, anaemia, dry harsh coat, hide bound, bottling of the jaw, and swelling of the dewlap. Death usually results from pneumonia or exhaustion.

Treatment.

Treatment with drugs administered by way of the digestive tract has not been found successful. Intratracheal injections and inhalations offer the best prospect for medicinal treatment, but need only be resorted to in cases of acute infestation. In such cases, it would be advisable to seek further information from the Live Stock Division of the Department of Agriculture, or avail oneself of the services of a practising veterinarian.

As stated previously, the termination of the disease depends upon the degree of infestation, and the state of the food supply. Where animals are removed from the source of infestation and there is abundant food, recovery will take place in the majority of cases, providing the infestation is not exceptionally heavy. Where good, natural or improved pasture is unobtainable, hand feeding, and the supply of a good mineral lick, should be resorted to in order to build up the condition of the animals.

Lungworms are seldom found as a sole infestation, and usually are associated with stomach and intestinal worms. Drenching as recommended previously will expel the latter to a very great extent, and affected animals, thus relieved, naturally do better and improve in condition.

Prevention of Worm Infestation.

Prevention should be directed especially towards protecting young animals, and such measures are based upon a knowledge of the life cycle of the parasites and good animal husbandry. Where stomach and lungworm infestation are troublesome the following measures should be adopted:—

1. Remove affected animals to clean pasture, and drench at least three times at fortnightly intervals.
2. Adopt a system of rotational grazing and spelling of paddocks. Horses may be grazed on paddocks being spelled. Sheep should not be used as they are readily parasitised with the stomach worm from cattle.
3. Weaner calves should not be grazed on areas which have previously been used for older cattle.
4. Provide adequate nutrition, and supply a good mineral lick such as recommended by the Department of Agriculture, and thus guard against lowering of resistance of animals through protein and mineral deficiency in pastures.
5. Burning off infested pastures should be considered, as this is a valuable aid to preventing infestation developing serious proportions. Care should be taken, however, not to prevent seeding of grasses.
6. Overstocking should be avoided, at least, until infestation is well under control.

The Cool Storage of Plums*

First Progress Report

By G. B. Tindale, B.Agr.Sc. (Department of Agriculture), S. A. Trout, Ph.D., M.Sc., and F. H. Heulin, Ph.D., B.Sc. (Council for Scientific and Industrial Research).

PLUMS are grown extensively in Victoria, and production is usually somewhat in excess of the demand on the local market. Recently many growers have sought a new outlet for their plums by shipping them overseas. When landed in good condition, good prices are realized, but unfortunately most of the consignments to date have been far from satisfactory, and have resulted in serious financial loss to the shippers.

It was with the object of obtaining information which might be of assistance to growers and shippers that cool storage and gas storage experiments with plums were conducted at the Experimental Chambers, Government Cool Stores, Melbourne. This report of the results of the experiments must be regarded as a progress report only, for it will be necessary to repeat the experiments over several seasons before the conclusions arrived at may be regarded as definite.

It should be mentioned here that plums have been cool stored in a limited way for many years. The usual practice has been to store well-coloured plums just approaching maturity, and in such instances a safe storage period up to a month has been experienced. This period is, of course, too short for successful export to Great Britain.

Experimental Procedure.

The experiments conducted last year were based on the results of previous pear storage experiments, in which it was found that pears picked in a quite immature condition, and promptly cool-stored, on removal to a ripening temperature could be ripened with full development of eating quality, provided however that the time each variety was in cool store did not exceed a certain period, termed the storage life of the variety. It has been found that a similar procedure may be adopted with plums, the important point being that by storing immature plums the storage life is greatly increased in comparison with that of more mature plums. By such methods, the storage life of several varieties has been increased to eight and occasionally even nine weeks, a period just sufficiently long to give the plum a possibility of successful export.

For the trials several well-known varieties of plums were obtained from the Doncaster and Eltham districts, near Melbourne. They were picked during the last two weeks of January by Messrs. F. J. Greatorex and G. M. Fletcher, Orchard Supervisors, and were selected at two stages of maturity:—(*a*) *Immature.* In all instances the plums were very hard and quite inedible. The red and blue plums were just showing the first signs of colouring, while the yellow varieties were still green. (*b*) *Approaching Maturity.* The plums were fully coloured and showing the first signs of softening, although not ripe enough for eating.

All plums were promptly stored at two temperatures—31 deg. and 34 deg. F.

Results.

As with pears, it was found that the longest storage life was obtained by storing the plums at the lowest possible temperature—31 deg. F. Below this temperature, the risk of freezing is too great. A small rise in temperature caused a very serious reduction in the length of storage life, the rise of 3 deg., from 31 to 34 deg., having the effect of reducing the length of storage life of all varieties by approximately 25 per cent., a reduction sufficiently great to reduce the storage life below that required for safe export to Great Britain.

The storage life of each variety, at both temperatures and both maturities, was determined by removing samples at weekly intervals, and transferring same to a ripening temperature. Up to a certain period, termed the storage life, the plums removed would ripen with full development of flavour, aroma, and lusciousness, but samples removed from cold storage at later

* The work reported in this paper has been carried out by the Victorian Department of Agriculture and the Council for Scientific and Industrial Research in co-operation. It was initiated and supervised by the Advisory Committee on Fruit Storage Investigations, comprising Dr. W. J. Young, Melbourne University and C.S.I.R., Messrs. S. Fish, and F. M. Read, Victorian Department of Agriculture, and Dr. J. R. Vickery, C.S.I.R.

intervals failed to ripen normally, although in cold storage they still appeared to be in excellent condition. The first abnormality noticed on ripening plums, the storage life of which was over, was a general mealiness of flesh associated with loss of flavour. With later removals a general browning around the stone was observed.

The abnormalities have been regarded previously as obscure diseases, but they should be regarded as normal changes to be expected in plums which have been kept too long in cool store.

Ripening After Storage.

It should be stressed here that plums picked and stored while immature will not develop eating quality in cool storage, although they will gradually develop full colour normal to the variety. This development of full colour, however, generally occurs when the storage life of the variety is over. For normal ripening it is necessary to transfer the plums from cool store to a ripening temperature before the storage life is over. The optimum ripening temperature is 65 deg. F., and at this temperature the plums will ripen in four to five days. The minimum ripening temperature is 50 deg. F., but at this temperature the period for ripening is nearly a fortnight. It is fortunate that plums will ripen at 50 deg., for this approximates to the atmospheric temperatures prevailing in the warehouses of England during March, the month in which plums shipped from Victoria would arrive in that country.

The varieties used in the experiment, together with the maximum length of storage life obtained with each variety when picked in the immature condition and promptly stored at 31 deg. F., are recorded in the accompanying table. It should be stressed that this maximum length of storage life would be reduced considerably if the plums were picked too mature, or were not promptly cool-stored, or if they were stored at a higher temperature.

Wickson	5 weeks.
October Purple	6 „
Ballena	6 „
Satsuma	7 „
Narabeen ..	7 „
President ..	7 „
Grand Duke ..	7 „
King Billy ..	7 „
Lawford Gage ..	8 „
Golden Drop ..	8 to 9 „

It will be seen that the European varieties, as a class, have a longer storage life than the Japanese varieties. With some Japanese varieties the storage life is so short as to eliminate them as an export proposition. The opportunities for tasting afforded by the trials suggested that the local seedling, King Billy, a blue plum, is possessed of very superior quality.

Gas Storage of Plums.

The use of gas storage as a supplement to cool storage has received much attention of recent years. It was thought that it might be of particular value with plums, the cold-storage life of which is so short. Experiments were therefore conducted to test out this method. Using the above cold-storage experiments as controls, a parallel set of experiments was conducted, the plums being stored in atmospheres containing—(*a*) 5 per cent. carbon dioxide; (*b*) 10 per cent. carbon dioxide; (*c*) 15 per cent. carbon dioxide. These atmospheric conditions were obtained by controlling ventilation, and although no precise measurements of oxygen concentration were made it can be taken that oxygen was proportionately reduced as carbon dioxide increased.

Instead of increasing the storage life, the gas-storage had just the opposite effect. Stored in 5 per cent. carbon dioxide the storage life, compared with the controls, was reduced by one week, while in 10 per cent. carbon dioxide the reduction was a fortnight. Fifteen per cent. of carbon dioxide proved definitely harmful, and resulted in serious browning of the flesh. Hence in storing or shipping plums it is necessary to provide for efficient ventilation in order to prevent any appreciable amount of carbon dioxide to accumulate.

It is obvious that further work on the relation between atmosphere and storage temperature is necessary before gas storage of plums can show any promise of success.

Conclusions.

(1) Owing to the limited storage life of all plum varieties, there is considerable risk attached to the export of plums overseas. Attention should be confined to those varieties with the longest storage lives, and in this respect the European varieties are generally superior to the Japanese varieties.

(2) To obtain the longest storage life plums should be picked when fully grown but when definitely immature. The red and blue varieties should show only the first signs of colour, while the yellow varieties should be still hard and green. In order to obtain the necessary size in plums, it may be necessary to thin the crop.

(3) After picking, the plums should be promptly cooled (termed pre-cooling) to a temperature of 31 deg. F., and then packed and shipped as soon as possible. On account of the short storage life of the plum, they should be shipped within a week of picking, which would mean that in practice the shipping period would be confined to approximately the last two weeks in January.

(4) The plums should be carried at a temperature of 31 deg. F.

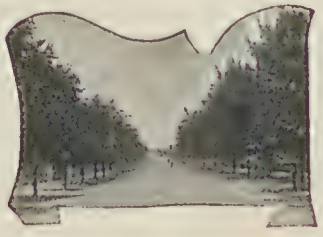
(5) Under the optimum conditions of maturity and storage the maximum storage life of any variety was eight to nine weeks, while with some varieties the storage life was as short as five weeks. This means that after storage for the length of time indicated plums removed from store will ripen normally, taking up to two weeks at 50 deg. F., but only four to five days at 65 deg. F. If allowed to remain in store longer than the indicated periods, the plums will not ripen normally at any temperature, but will become mealy and/or brown around the stone.

(6) The ships' holds should be well ventilated in order to prevent any accumulation of carbon dioxide, for plums appear very susceptible to carbon dioxide injury.

Export of Poultry to New Zealand

BY an Order in Council issued recently, the Government of New Zealand has prohibited the introduction to that Dominion, except conditionally, of poultry from any country. The Order in Council is as follows:—

"In pursuance and exercise of the powers and authorities conferred upon him by section forty-six of the *Customs Act* 1913, as amended by the *Customs Amendment Act* 1921, and of every other power and authority enabling him in this behalf, His Excellency the Governor-General of the Dominion of New Zealand, acting by and with the advice and consent of the Executive Council of the said Dominion, doth hereby revoke the Order in Council restricting to the extent specified therein the importation into New Zealand of poultry from any country, made under the said Act on the 27th day of April, 1931, and published in the *Gazette* on the 30th day of the same month at page 1363, and doth hereby prohibit the importation save with the consent of the Minister of Agriculture, of any live poultry (including domestic fowls, ducks, geese, and turkeys) from any country; and doth hereby declare that such revocation shall take effect, and this Order in Council shall come into force, on the date of the publication thereof in the *New Zealand Gazette*."



Manurial Trials on Potatoes

Results for 1934-35

By J. T. Ramsay, Potato Expert.

The results of the experiments at Beech Forest, Koroit, Wheatsheaf, Trentham East, Musk, and Romsey were published in the October issue of this Journal.

FISH CREEK.

THE yields from the experimental potato plots in this district generally are amongst the highest recorded in the State. This year, however, the abnormal seasonal conditions, which favoured the development of Irish blight, resulted in the yields from the variously treated plots being much below the average. In spite of the low yields obtained, striking increases in the weight of marketable tubers again were recorded in favour of the manured areas as compared with those unmanured.

The outstanding treatment has been the well known mixture 6 and 1 (super. and ammonia). It gave not only the greatest yield per acre, but also the greatest cash profit. This manurial combination has been remarkably consistent since it was first used, and it is being applied to potato crops throughout the Commonwealth.

During the past three years, at Fish Creek, a dressing of 6 cwt. super. and 2 cwt.

TABLE I.—POTATO MANURIAL TRIALS, FISH CREEK, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 3 cwt. ..	3 8	1 5	58
Super., 4½ cwt. ..	3 10	1 7	63
Super., 6 cwt. ..	3 15	1 12	74
Super., 6 cwt. + amm. sulp., 1 cwt. ..	4 1	1 18	88
No manure	2 3	..	..
Super., 6 cwt. + amm. sulp., 2 cwt. ..	3 18	1 15	81
Super., 6 cwt. + amm. sulp., 1 cwt. + pot. sulp., 1 cwt. ..	3 15	1 12	74
Basic phosphate, 6 cwt.	3 5	1 2	51

TABLE II.—AVERAGE RESULTS, FISH CREEK, FOR SEVEN YEARS, 1928-29 TO 1934-35.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 3 cwt.	6 13	44
Super., 6 cwt.	7 5	57
Super., 6 cwt. + amm. sulp., 1 cwt.	7 15	68
Super., 6 cwt. + amm. sulp., 2 cwt.	7 8	70*
No manure	4 12	..
Super., 6 cwt. + amm. sulp., 1 cwt. + pot. sulp., 1 cwt.	7 1	53
Market garden, 6 cwt.	6 13	38†
Basic phosphate, 6 cwt. ..	5 14	34‡

* Three years only. † Five years only. ‡ Six years only.

ammonium sulphate has been included, and although the average increase, due to this combination for that time, is slightly greater than the average increase due to the 6 and 1 mixture, for the whole period of the experiment (seven years), it is not sufficient to justify the extra cost of fertilizer, and therefore is not recommended at present.

On the recommendation of the Departmental Standing Committee on Field Plot Technique, an extra plot, viz., superphosphate at the rate of 4½ cwt. per acre, was introduced last season in the two Gippsland areas, Fish Creek and Warragul. The object of this innovation was to indicate whether this dressing would displace the more or less recognized application of 6 cwt. super. per acre. At each centre, the heavier application gave the greater yield. This variation in the amount of superphosphate will be continued so that the effect under varying seasonal conditions can be studied.

The results of last seasons trials at Fish Creek are shown in Table I., while the averages of the various manures for the full period of the tests are shown in Table II.

ILLOWA.

The increases due to manurial applications were not as marked as usual at Illowa during the past season, but were high enough to justify the expenditure involved in their application. This of course is particularly evident in seasons of high prices such as the one experienced recently.

TABLE III.—POTATO MANURIAL TRIALS, ILLOWA, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	8 3	1 5	18
Super., 3 cwt. ..	8 17	1 19	28
Super., 4 cwt. ..	8 6	1 8	20
No manure	6 18	..	..
Super., 3 cwt. + amm. sulp., 1 cwt. ..	7 15	0 17	12
Super., 3 cwt. + amm. sulp., 2 cwt. ..	7 4	0 6	4
Basic phosphate, 3 cwt.	6 8	0 10	7

TABLE IV.—AVERAGE RESULTS, ILLOWA, FOR SEVEN YEARS, 1928-29 TO 1934-35.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	7 0	35
Super., 3 cwt.	7 13	47
Super., 4 cwt.	7 14	50
No manure	5 4	..
Super., 3 cwt. + amm. sulp., 1 cwt.	8 1	55
Super., 3 cwt. + amm. sulp., 2 cwt.	5 11	25*
Market garden, 3 cwt.	6 19	40†
Basic phosphate, 3 cwt. ..	6 7	22

* Two years only. † Six years only.

Climatic conditions were particularly favourable in this district during the potato season, and this no doubt contributed towards the smaller increases recorded from fertilizer treatment. For the first time at Illowa, the super. alone plot yielded heavier than the super.-ammonia mixture. Over the seven years of the tests, however, the "3 and 1" mixture has proved to be the most beneficial treatment.

The yields obtained for the past season, and the averages for the period of the trials are shown in Tables III. and IV.

WARRAGUL.

At this centre, as at Fish Creek, the 3 cwt., 4½ cwt., and 6 cwt. dressing of superphosphate show progressively higher returns in favour of the heavier application. Because of the consistently low returns from the 3 cwt. dressing, it is intended to omit it from future trials in the Gippsland districts. The intermediate dressing of 4½ cwt. super., however, will be tested further.

TABLE V.—POTATO MANURIAL TRIALS, WARRAGUL, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.	Extra 2 cwt. Potash.
	T. C.	T. C.	%	T. T.
Super., 3 cwt. ..	5 16	0 6	5	6 5
Super., 4½ cwt. ..	6 0	0 10	9	6 5
Super., 6 cwt. ..	6 10	1 10	27	7 10
Super., 6 cwt. + pot. sulp., 1 cwt. ..	8 0	2 10	45	7 10
No manure ..	5 10	..	..	6 5
Super., 6 cwt. + pot. sulp., 2 cwt. ..	8 0	2 10	45	8 10
Super., 6 cwt. + sulp. amm., 1 cwt. ..	8 10	3 0	54	8 10
Super., 6 cwt. + pot. sulp., 1 cwt. + amm. sulp., 1 cwt. ..	8 16	3 6	60	8 10
Basic super., 6 cwt. ..	7 10	2 0	..	6 5

The yields from the various potash and ammonia mixtures during the past season are somewhat erratic and not easily reconciled with previous figures. For the second time only in nine years, has sulphate of ammonia given a heavier yield than potash. This, however, does not materially affect the average results of each of these manures on the period of experimentation. Indeed, it merely points to the necessity for continuing these trials until sufficient results are obtained to give a definite guide to growers.

TABLE VI.—AVERAGE RESULTS, WARRAGUL, FOR SEVEN YEARS, 1926-27 TO 1934-35.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 3 cwt.	6 13	56
Super., 4½ cwt.	6 0	9*
Super., 6 cwt.	7 8	74
Super., 6 cwt. + pot. sulp., 1 cwt.	8 11	101
No manure	4 5	..
Super., 6 cwt. + pot. sulp., 2 cwt.	6 16	51†
Super., 6 cwt. + sulp. amm., 1 cwt.	8 1	90
Super., 6 cwt. + pot. sulp., 1 cwt. + amm. sulp., 1 cwt. ..	8 12	102
Basic super., 6 cwt.	6 0	46‡

* One year only. † Three years only. ‡ Six years only.

At Warragul last season, an extra dressing of 2 cwt. potassium sulphate was applied across all the manured plots. Of nine manurial variations, thus treated, five showed an increase, but the aggregate increase over all, amounted to 1 ton only, approximately.

Details of the returns are shown in Tables V. and VI.

Brown Coal Dust.

During the past two years, experiments have been carried out at Warragul with brown coal dust, with most conflicting results. During the first season there was no increase in yield due to this material. Last season, the dust was applied across the manurial trials at two different rates, viz., 6 and 12 tons per acre, in duplicate. On each manurial plot there was an average increase in yield of approximately 1 ton of tubers per acre, due to both of the dust applications, the greatest increases occurring on the "no manure" and the "super. only" plots.

From the results which appear in Table VII., it will be seen that there are no significant returns.

Although there is no nutrient value (on analysis) in brown coal, it is possible that it may have some fungicidal property. This is indicated by the fact that on all plots not receiving the dust, 30 per cent. damage, due to blight, occurred, whereas on the treated areas there was 5 per cent. damage only. Further investigations are being conducted to ascertain if brown coal dust does possess any fungicidal properties.

At the moment, because of the cost involved in application, brown coal cannot be considered an economic proposition by potato growers.

TABLE VII.—POTATO MANURIAL TRIALS, WARRAGUL, BROWN COAL DUST, 1934-35.

Manure per Acre.	Weight Marketable Tubers.		
	Manure only.	Brown Coal 12 tons.	Brown Coal 6 tons.
	T. C.	T. C.	T. C.
Super., 3 cwt.	5 16	7 10	7 10
Super., 4½ cwt.	6 0	8 7	8 7
Super., 6 cwt.	6 10	7 12	8 2
Super., 6 cwt. + pot. sulp., 1 cwt.	8 0	8 3	8 5
No manure	5 10	7 0	7 0
Super., 6 cwt. + pot. sulp., 2 cwt.	8 0	7 15	8 0
Super., 6 cwt. + amm. sulp., 1 cwt.	8 10	7 12	7 15
Super., 6 cwt. + amm. sulp., 1 cwt. + pot. sulp., 1 cwt.	8 16	9 6	9 7
Basic super., 6 cwt. ..	7 10	8 2	8 2

MILLBROOK.

The tests at Millbrook are particularly interesting, because in addition to the manurial trials, many other experiments are conducted, including "Variety," "Disease Control," "Cultivation," "Storage," "Selection," and "Bare Fallow versus Green Manure" tests.

The soil of the district is a red volcanic loam of good quality, but not comparable in inherent fertility with some of the volcanic country a few miles to the north. It has been under cultivation for a long period of years and was chosen for the experimental work because it is regarded as being typical of much of the land in the central highlands of Victoria devoted to potato cultivation. As in many parts of the State, the season was one of the richest on record, nevertheless some very useful comparative figures and corroborative information resulted from the year's work.

Variety Trials.

The outstanding variety for yield was the Late Carman, which is one of the most extensively grown sorts in Victoria. This variety is a sport, by bud variation, which was selected from the early Carman (Rural New Yorker) by the late Mr. Jas. Cook, of Romsey, who introduced the latter from America about fifty years ago.

Late Carman is admirably suited to Victorian conditions as it has retained its cropping capacity for so long in spite of the fact that little attention has been given to any degree of systematic selection. Only a few years ago at Coleraine (Victoria), a crop of this variety yielded over 25 tons of marketable tubers per acre, all of excellent type and quality.

All of the varieties tested at Millbrook last year, suffered from Irish blight, the degree of damage being about 25 per cent. The occurrence of this fungus in epidemic form in Victoria, however, is so rare (the last serious general outbreak was in the season 1910-11), that systematic spraying (in Victoria), for its control is not an economic proposition. None of the varieties tested showed any marked variations in susceptibility to blight. While

TABLE VIII.—VARIETAL TESTS, MILLBROOK, 1934-35.

Variety.	3 and 1 + 2 cwt. Potash. Weight Marketable Tubers.	3 and 1. Weight Marketable Tubers.
	T. C.	T. C.
White Early Rose ..	3 17	3 17
Bismark	4 14	5 2
Carman No. 1	4 17	5 16
Earliest of All (selected) ..	4 3	4 3
Earliest of All (run) ..	3 6	3 6
Field Marshall	..	4 3
Scottish Triumph ..	5 5	5 11
Coronation	4 8	4 11
Late Manistee	3 9	3 9
Up to Date	5 11	5 17
Excelsior	4 11	4 11
Ruby Red	7 12	8 6
Plunkett	4 11	4 11
Carman No. 3	9 6	9 9

the yields of the majority of the varieties are only moderate, they are regarded as satisfactory for the season.

All varieties were subject to two manurings, (*a*) "3 and 1" super. and ammonia + 2 cwt. per acre potassium sulphate, and (*b*) "3 and 1" only. It is consistent with previous findings at Millbrook, that out of 13 sorts tested, seven gave a depressed yield where potash was applied, the remaining six yielding the same quantities as the "3 and 1" only, i.e., in no case did potash bring about an increase in yield.

The results of the variety trials are set out in Table VIII.

The Earliest of All variety, on account of its extremely fast growing characteristic, was twice frosted, while the other varieties not having reached a stage of high susceptibility to frost, escaped damage. The yield of this variety was consequently severely reduced.

Manurial Trials.

In this series of replicated trials, all of the manurial treatments received an added quantity of potassium sulphate at the rate of 2 cwt. per acre. In no case was there any improvement recorded from the potash dressing, and in fact the yields of the 4 cwt. superphosphate and the "3 and 2" mixture plots were reduced a little. (See Table IX.)

Substantial increases were obtained from the other manures ranging from 51 per cent. in the case of basic phosphate to 106 per cent. in the case of the "3 and 1" mixture." The latter figure confirms the results obtained in previous years. The addition of an extra cwt. of ammonium sulphate does not appear to be justified by the results obtained during the past three years. Three hundredweight of superphosphate seems to be the optimum dressing of this fertilizer on this class of soil.

The results obtained during the eight years of these tests—with the exception of the "3 and 2" mixture—have been both striking and consistent. (See Table X.)

TABLE IX.—MANURIAL TRIALS AND EFFECT OF POTASH, MILLBROOK, 1934-35.

Manure per Acre.	Weight Marketable Tubers.	Weight Marketable Tubers, + 2 cwt. Potash.	Percentage Increase over "No Manure" (without Potash).
	T. C.	T. C.	%
Super., 2 cwt. ..	7 11	7 11	66
Super., 3 cwt. ..	8 0	8 0	76
Super., 4 cwt. ..	7 15	7 12	70
No manure	4 11	4 11	..
Super., 3 cwt. + amm. sulp., 1 cwt. ..	9 8	9 8	106
Super., 3 cwt. + amm. sulp., 2 cwt. ..	9 3	8 17	100
Basic phosphate, 3 cwt.	6 18	6 18	51

TABLE X.—AVERAGE RESULTS, MILLBROOK, FOR EIGHT YEARS, 1927-28 TO 1934-35.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	4 2	58
Super., 3 cwt.	4 14	81
Super., 4 cwt.	4 10	73
No manure	2 12	..
Super., 3 cwt. + amm. sulp., 1 cwt.	5 13	117
Super., 3 cwt. + amm. sulp., 2 cwt.	6 19	104*
Basic phosphate, 3 cwt. ..	3 19	52

* For three years only.

Disease Control.

The control of diseases affecting the potato crop is becoming an increasingly important part of the potato growers operations. It is not economical to go to the considerable expense involved in systematically spraying each year (i.e. under Victorian conditions) for such a sporadic disease as Irish blight. There are, however, other very common diseases such as collar stem rot (*Rhizoctonia solani*) and

common scab (*Oospora scabies*) which, in the aggregate, cause infinitely more damage than Irish blight, but their control is a comparatively easy matter.

The selection of seed contributes largely towards reducing the damage caused by these diseases, and the dipping of seed in a formalin solution has been proved to be highly effective. The formalin control method has been tested out at Millbrook during the past five years, and the results are so striking that the complete figures for that period are given in Table XI. The cost of material is small. As dipping can be done at any time during the storage period, between harvesting and planting, the large amount of labour involved need not be considered very seriously, because it provides a useful avenue of employment during the winter, when outside work is not practicable.

The strength of the dip recommended is 1 lb. formalin to 20 gallons of water if the seed is treated prior to sprouting, and 1 lb. to 30 gallons if sprouting has taken place. The period of immersion in either case should be one and a half hours.

TABLE XI.—FORMALIN DIPPING TESTS, MILLBROOK, 1929-30 TO 1934-35.

Season.	Yield.		Increase due to dipping.
	Undipped.	Dipped.	
	T. C.	T. C.	T. C.
1929–30	1 10	5 0	3 10
1931–32	4 0	6 12	2 12
1932–33	3 17	6 18	3 1
1933–34	3 15	6 19	3 4
1934–35	6 5	9 8	3 3
Total yield for five seasons	19 7	34 17	15 10
Average for five seasons	3 17	7 19	3 2

The percentage increase in favour of dipping over the period of the trials = 80 per cent.

Cultivation Tests.

The cultivation tests continue to demonstrate the considerable benefit to be derived from adequate inter-cultivation of the crop. These tests comprise three sections, the first of which is given one horse hoeing, the second two, and the third three.

The results are shown in Table XII.

TABLE XII.—CULTIVATION TESTS, MILLBROOK, 1934-35.

—	1934–35.		Average for nine years 1926–27 to 1934–35.	
	—	Percentage Increase.	—	Percentage Increase.
	T. C.	%	T. C.	%
One cultivation	6 18	..	4 10	..
Two cultivations	8 3	**18**	5 14	**27**
Three cultivations	9 8	**36**	6 14	**49**

Storage.

In this test the systems of storage under trial are "Boxed Seed versus Bagged Seed."

The results obtained during the past season demonstrate clearly the effect on yield of proper storage methods. Boxed seed allows for the proper ventilation and light requirements without impairing the vitality of the seed, while the effect of bagging is to prevent these necessary functions.

The subject of storage has been dealt with very fully in the bulletin on potato growing published by this Department.

The figures for the 1934-35 season and the average results obtained over the past nine years are shown in Table XIII.

TABLE XIII.—BOXED VERSUS BAGGED SEED, MILLBROOK.

—	1934–35.		Nine years' average 1926–27 to 1934–35.	
	—	Percentage Increase.	—	Percentage Increase.
	T. C.	%	T. C.	%
Bagged seed ..	6 13	..	3 4	..
Boxed seed ..	9 8	**41**	6 2	**91**

Seed Selection.

The use of virile seed in potato growing is one of the most important factors which go to make up the difference between a low and high yielding crop. According to the Government Statist, the average yield for Victoria is 3 tons per acre, and there is no reason why this average could not be materially increased by giving careful attention to this one factor alone. Continuous, or at least periodic, selection of the seed is necessary if the standard

of production is to be improved or indeed maintained.

The tests at Millbrook, which have been in operation for ten years, demonstrate conclusively that highly significant increases are to be expected from the use of properly selected seed.

The results obtained during the 1934-35 season, and the average results for the past ten years are shown in Table XIV.

TABLE XIV.—SEED SELECTION TESTS, MILLBROOK.

	1934-35.		Ten years' average 1925-26 to 1934-35.	
	—	Percentage Increase.	—	Percentage Increase.
	T. C.	%	T. C.	%
Un-selected seed	3 6	..	5 10	..
Selected seed ..	4 3	26	7 10	36

Green Manurial Test.

Much of the potato country in Victoria has been reduced, through excessive cropping, to a condition which makes it difficult not only to produce a satisfactory crop, but also to retain the tilth necessary to meet the requirements of the potato crop. Lime has proved unsuccessful in correcting this condition, while farmyard manure, though satisfactory for the purpose, is not available in sufficient quantities. Green manure, on the other hand, can be made available, is cheap, and highly efficient, and it is safe to predict that, until this practice is adopted as rotational farm procedure, there are certain soils in this State which will never be brought back to anything approaching their former condition. Green manuring means the growing of any crop for the sole purpose of ploughing it under. It then acts not only as a manure, but also as a physical reconditioning agent. (See Table XV.). Certain crops lend themselves more than others for this purpose, and amongst the best of these is rye. This cereal is capable of producing a bulk of green stuff, which if ploughed under at the right stage—viz., when in the shot-blade—will work wonders in meliorating any ill-conditioned soils.

TABLE XV.—AVERAGE RESULTS, "GREEN MANURE VERSUS BARE FALLOW" TEST, MILLBROOK, 1934-35.

Manure per Acre.	Green Manure.	Bare Fallow.	Increase Due to Green Manure.	Percentage Increase.
	T. C.	T. C.	T. C.	%
No manure ..	4 11	2 15	1 16	65
Super., 3 cwt. ..	8 0	5 11	2 9	44
Super., 3 cwt. + amm. sulp., 1 cwt. ..	9 8	6 7	3 1	48

From the figures shown in Table XV., it will be seen that the greatest increase was obtained on the unmanured plot, definitely showing the value of green manure as a fertilizer. The practice of green manuring also is cheap, clean, easy to perform, and effective.

Bare fallow, while it may be advantageous in districts where the rainfall is so low that a program of yearly cropping is out of the question, should not be practised in any situation where the soil and climate favour the growth of root crops.

Brown Coal Dust.

At Millbrook, brown coal dust tests were carried out in conjunction with the "Green Manure versus Bare Fallow" trials. Applications of 6 and 12 tons per acre, were applied across the manurial strips in each case in duplicate.

The results obtained, which are shown in Table XVI., are far from being conclusive.

TABLE XVI.—BROWN COAL DUST TESTS, MILLBROOK, 1934-35.

Manure per Acre.	Manure only.	Brown coal dust on Green Manurial Trial.	
		6 tons per acre.	12 tons per acre.
	T. C.	T. C.	T. C.
Super., 2 cwt.	7 4	5 8	5 11
Super., 3 cwt.	8 0	6 15	6 15
Super., 4 cwt.	7 15	7 6	7 6
No manure	4 11	5 16	5 16
Super., 3 cwt. + amm. sulp., 1 cwt.	9 8	8 11	8 11
Super., 3 cwt. + amm. sulp., 2 cwt.	9 3	8 3	7 17
Basic phosphate, 3 cwt. ..	6 18	7 4	7 1
		Brown coal dust on bare fallow.	
Super., 3 cwt.	5 11	5 13	5 16
Super., 3 cwt. + amm. sulp., 1 cwt.	6 7	6 3	6 4
No manure	2 15	3 9	3 7

Champion Butter-Fat and Milk Test

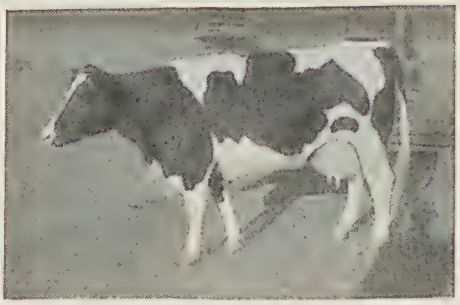
Royal Show Prize Winners

THE champion butter-fat and milk test at the recent show of the Royal Agricultural Society of Victoria was won by the Friesian cow, Ingolston Inka Josie, with an average of 68.58 lb. milk and 2.09 lb. butter-fat per day.

This competition, which was judged by Messrs. W. R. Jewell, Agricultural Research Chemist, and D. R. McKenzie, Senior Dairy Supervisor, was open to all pure-bred cows. On the morning and evening of the day before the test began the competing cows were milked dry under supervision. They were then milked at 7 a.m. and 6 p.m. on three successive days, the milk being weighed and subjected to the Gerber test for the determination of butter-fat. The prize was awarded to the cow whose milk gave the highest monetary return, the returns being determined according to the market value of butter-fat during the week of the competition and the non-fatty solid content of the skim milk.

Although sixteen entries were received a number had to be withdrawn because the animals did not calve in time. Considerable interest was taken by breeders in this competition, and it is anticipated that the number of entries will be increased at the next Royal Show.

Ingolston Inka Josie, this year's winner, is the property of the Salesian College, Sunbury, and was bred by Messrs. T. Gilmour and Sons.



The winning cow "Ingolston Inka Josie."

This young cow already has proved herself a great producer, yielding 627.21 lb. butter-fat in her last lactation period under the Standard Herd Test.

Messrs. James Lidgett and Sons' Braelands Pearl Roan 7th, an eleven years' old Dairy Shorthorn, gained second place, with an average of 55.23 lb. milk and 2.02 lb. butter-fat per day. This cow has been a consistent performer in this test at the Royal Show, being first in 1933, and second in 1934.

The third prize was awarded to the Ayrshire cow Glengowrie Ray, owned by Mr. G. A. Fraser, of Addington. She produced 49.7 lb. milk and 1.97 lb. butter-fat per day during the test.

It is recognized that cows in strange surroundings may become excited, and in consequence do not give their best results. This is

ROYAL AGRICULTURAL SOCIETY'S BUTTER-FAT AND MILK TEST COMPETITION, 1935.

Name of Cow.	Total Milk Yield in lb. (3 days.)	Average Test per cent.	Butter-fat in lb.	Value of non-fatty solid content of skim milk @ 1d. per gallon.	Value of butter-fat @ 1s. 3d. per lb.	Total Value of Production.
				s. d.	*s. d.*	*s. d.*
Ingolston Inka Josie	205·75	3·05	6·277	1 8·92	7 10·155	9 7·075
Braelands Pearl Roan 7th	165·70	3·65	6·049	1 5·478	7 6·735	9 0·213
Glengowrie Ray	149·10	3·96	5·906	1 3·488	7 4·59	8 8·078
Steventon Dog Rose	169·50	3·20	5·417	1 5·664	6 9·255	8 2·919
Victoria Soprano	172·85	3·01	5·208	1 6·169	6 6·12	8 0·289
Gleneira Dandelion	117·40	3·51	4·120	1 0·803	5 1·80	6 2·603

particularly the case with high-producing animals which are of a more nervous temperament and more easily upset. In spite of this, it is considered that the arrangements made for the competing cows were satisfactory, a corner of the main cattle pavilion being set apart for their accommodation. This was enclosed by wire-netting and hessian, thus excluding traffic which would otherwise have had a disturbing effect upon them.

Frequently a cow occupies a high place in the owner's estimation, but perhaps undeservedly. A true comparison with other members of the herd can only be made by testing, and the Royal Agricultural Society is doing its part to improve the lot of the dairy farmer by conducting a competition which demonstrates the value of herd testing work.

The results of the competition are set out in the accompanying table.

Victorian Fruit in London

(Continued from page 533.)

pears realized less money. We noticed also with Packhams that some were clean and bright, while others were dull and spotted, although all were packed under the same brand. We do think that more stringent regulations should be put into force regarding the grading of pears.

Liverpool Merchants.

The main feature, we feel, is the consistently higher levels of prices which have been returned for apples, as compared with the unfavorable results of previous seasons, and whilst condition mainly has left little to be desired, the same might be applicable as regards packing, &c., since we do not feel there is any suggestion which we might make that would materially improve values. The box, packing, and where used the label—are all of an attractive nature. Colour, especially in Romes, which variety has in the past tended to land rather pale, especially in the earlier shipments, has also manifested an improvement this year.

Glasgow Merchants.

During the past season there was a noticeable improvement in grading and packing of Victorian apples, and we are pleased to say, too, that the condition generally was quite satisfactory. The minimum colour requirement seems to have achieved definite results, but we ourselves feel that in some of the coloured varieties a heavier percentage of colour should be insisted upon. This feeling was expressed to us by several merchants during the past season.

Hull Merchants.

We consider the general out-turn, &c., of the fruit has been an improvement on past seasons. The chief trouble this season seems to have been that on more than one occasion the steamers have arrived from Australia before arrival of the mail, and several receivers at times had to receive their fruit without any classification. These classifications very often come with documents, which are generally not entrusted to air mail. When fruit is shipped by fast steamers such as we have seen this season, we think arrangements might be made whereby a copy of specifications might be delivered by the ship's mail.

Another Hull Merchant.

We have much pleasure in making the following observations regarding the Victorian apples which we have handled at this port during the past season:—

Condition.—Generally sound throughout, with the exception of a few odd parcels of London Pippins. At times a certain amount of bruising was noticeable, more particularly perhaps in Jonathans and Rome Beauties.

Colour.—After first two steamers, in which Jonathans were definitely backward, colour was generally good, with the exception that Rome Beauties were short of colour and streaky throughout the season.

Grading.—Good, except a few odd parcels of large fruit.

Packing.—Good, with "counts" more attractive in appearance than sizes.

Colour Regulations.—There was really very little to choose between "extra fancy" and "fancy," and prices on this market have not shown much variation between the two grades. This may, perhaps, be explained by the fact that, in our opinion, the quality of both "Extra Fancy" and "Fancy Fruit" was almost uniform.

The Bulb Eelworm and its Control

By C. R. Millikan, M.Agr.Sc., Assistant Plant Pathologist

THE stem or bulb eelworm (*Anguillulina dipsaci* (Kuhn), Gerv. and v. Ben.), is a very common pest of narcissus and hyacinths, and, under favorable conditions, is capable of causing severe damage. This pest is world-wide in its distribution, and is liable to occur wherever bulbs are grown. The bulb eelworm has been present in Victoria for a number of years, and in some instances has resulted in considerable loss to growers. In addition, *A. dipsaci* has been recorded for all the principal bulb-growing countries of the world, such as England, Holland, America, &c., in each of which it is a most serious menace to successful bulb culture.

In view of its widespread distribution and importance as a disease-producing organism, it is necessary that precautions be taken to prevent the introduction of this pest into clean areas as a result of planting infested bulbs. The damage done to infested bulbs may be reduced by proper treatment.

Fig. 1.—Narcissus leaves showing characteristic development of spikkels.

Fig. 2. — Affected narcissus plants — Left, Heavy infection; Right, Light infection showing isolated spikkels.

Symptoms.

Although both the bulb and leaves are attacked by the parasite, the first symptoms of infection generally are to be found in the foliage, in the form of small lumps or blisters, which have been called "spikkels" by florists of the Old World (Fig. 1). They occur on both surfaces of the leaf, and are readily felt when such leaves are drawn between the fingers. As the plant matures, the spikkels crack open and turn brown, while the area immediately surrounding each becomes yellowish in colour.

In more severe cases of infestation, the leaves and flower stalks become thickened and distorted, and often die when only a few inches above the ground (Fig. 2). If flowers are produced in such plants they are generally late and ill-formed.

Symptoms of attack often are not visible externally in infected bulbs, but when cut across, such bulbs show concentric rings of brown diseased tissue (Fig. 3) in which the worms may be found. During storage considerable loss may occur, as such bulbs are very prone to decay.

Description and Life History.

As already mentioned, the organism causing this disease of narcissus is the eelworm *Anguillulina dipsaci*. Eelworms belong to the class of round or thread worms known as nematodes, and as such are to be distinguished from other forms of worms like flatworms, tapeworms, and earthworms. Although many nematodes are either internal parasites of other animals or are free-living in the soil, feeding on decaying animal or vegetable matter, there are many important parasitic forms, such as *A. dipsaci*, which attack only living plants. As may be seen in Fig. 4, the adult male and female of *A. dipsaci* are both very slender and wormlike. They are both colourless and are scarcely visible to the naked eye, being approximately 1.0 to 1.5 millimeters long by 0.03 to 0.06 millimeters wide. The body tapers at both ends, but particularly posteriorly to form a very pointed tail.

Fig. 3.—Cross-section of narcissus bulb, attacked by A. dipsaci, showing brown ring symptoms.

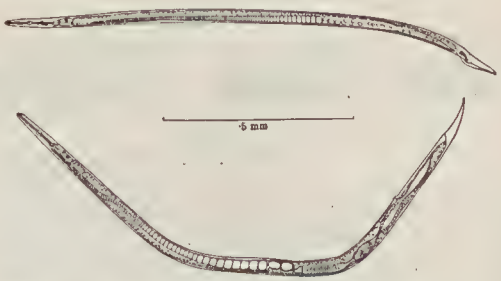


Fig. 4.—Adult eelworms—Upper, male; Lower, female.

[From Goodey, *Jour. Helm.*

Eggs may be laid at any time during the year, and under favorable conditions approximately 30 days are required for growth from the egg to sexual maturity. These eggs are very minute, and a considerable number may be laid by each individual. Just prior to hatching the young larva may be seen coiled up inside the egg. After hatching, these larvae continue to develop until a pre-adult stage is reached. All stages of the nematode, i.e., eggs, larvae, and adults, may be found together in diseased bulbs. The pre-adult larva is the important infective stage, as large numbers of worms in this stage leave infested bulbs and migrate into the soil where they are capable of moving a considerable distance (up to 3 feet) from one plant to another, thus spreading the disease.

Should the infected bulbs be lifted and dried, these pre-adult larvae dry out also, and coil up like a watch spring, often emerging at the base of the bulb, where they appear as whitish tufts. In this stage they are a potential source of infection of healthy bulbs, as they are easily shaken off when the bulbs are moved. The dried larvae are very resistant, and may remain dormant for up to six and a half years, as they are well supplied with an abundance of reserve food material. When conditions become favorable, they resume active growth, and are capable of setting up fresh infections. Infection may also be spread by infected soil being carried on implements, horses' hoofs, or by surface water.

It has been shown that the worms may enter the leaves of the plant through the stomata. The leaves of narcissus probably become infected as they pass up from the neck of the bulb, while the bulb itself may be infected through the parasite entering at the neck or through the base at the point where the roots are developed. In either case, they migrate

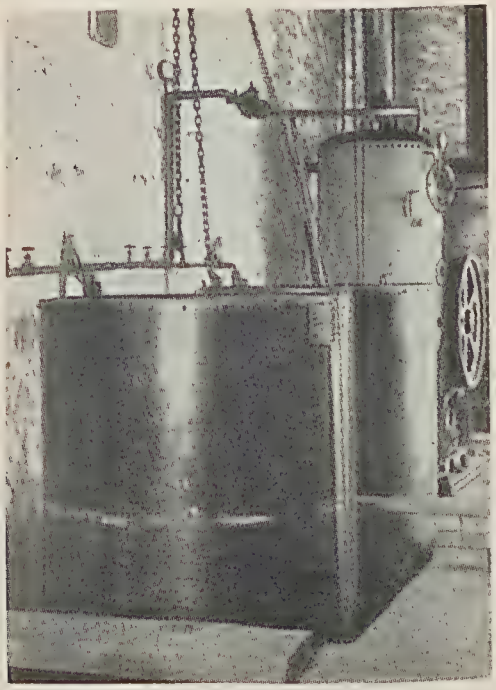


Fig. 5.—Bulb-treating plant.
[After Gibson, *Jour. Min. Agr.*

down between the bulb scales, producing the brown ring symptoms already described. On the other hand, it is probable that the parasites which enter the leaves do not migrate to the bulbs, but become quiescent towards the end of the season.

While the parasites have been known to live for several years in a dormant state in dried bulbs, experiments have shown that they may die within a considerably shorter time in moist soil in the absence of a suitable host plant, as in a moist environment they are unable to become dormant.

Specialization of A. dipsaci.

Although *A. dipsaci* was first described in 1858 by Kuhn, it was not recorded on hyacinth until approximately 1880, while the earliest record for the parasite on narcissus is comparatively recent, being first observed in 1905.

Different strains of *A. dipsaci* are now known to attack over 200 different species of both wild and cultivated plants, including many of economic importance, such as lucerne, onions, oats, peas, potatoes, tulips, &c. While being apparently similar in appearance, each particular strain is very limited in its host range, and it has been found very difficult to transfer artificially any one strain to plants outside its particular host range. Apparently, the worm prefers to attack the same type of plant as that upon which its ancestors lived, and will often fail to become established in any other potential host plant. The degree of specialization increases with the length of time that the strain has infested the one plant.

Thus, *A. dipsaci* attacks both narcissus and hyacinth, but they are two distinct strains of the parasite, as it is not possible to infect narcissus with the hyacinth strain, and vice versa. This specialization is important when one considers the control of the pest, as it is possible to starve out the narcissus strain from an infected area by growing other non-susceptible crops. It is important, however, to note that onions and certain weeds, such as rib-grass (*Plantago lanceolata* and *P. major*), can act as hosts of the narcissus strain of the parasite.

Control Measures.

(1) *Bulb Treatment.*—The hot water treatment of narcissus and hyacinth bulbs for the control of eelworm is very widely practised in the Old World, and has been found to be very effective. This treatment is based upon the fact that all stages of the worm are killed at a relatively low temperature. The standard method employed is to immerse the bulbs in water at 110 deg. Fahrenheit for three hours. The time of submersion is calculated from the time at which the water regains the loss of temperature after the bulbs were submerged.

The apparatus used for this purpose (see Fig. 5) should be such that the temperature can be brought rapidly up to 110 deg. F., and maintained at that temperature without varying more than 2 degrees on either side. The bulbs should be lowered into the tank in bags or metal containers which will allow as free a circulation of water as possible.

Where the temperature rises above 112 deg. F., or where the bulbs are not properly mature before treatment, marked injury to the flowers may be noticed later in the season. The bulbs either fail to bloom altogether, or a marked splitting of the petals and cup occurs (Fig. 6). Bulbs that have been thoroughly ripened prior to treatment are much less liable to injury than those which have not, and are not injured by a temperature of 110 deg. F., even if maintained for several hours. Treatment, therefore,

should be given while the bulbs are fully dormant, i.e., when the flower-bud is not growing within the bulb, and before the roots begin to appear.

Treated bulbs should be allowed to cool slowly, with the minimum of exposure to weather. This is done by leaving them in the bags for 12 to 24 hours, after which they should be dried as quickly as possible by frequent turning and exposure to light currents of air to prevent fermentation.

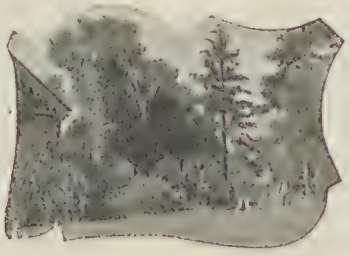
The greatest care should be taken to prevent re-infection of treated bulbs through their coming into contact with unclean trays, sacks, &c., which would probably contain large numbers of dried larvae.

Even though treatment has been entirely satisfactory, the brown rings may still be found in treated bulbs for several years afterwards, until sufficent numbers of new scales have been produced, when the damaged scales will be thrown off. Treated bulbs should be planted in areas which are free from the pest, otherwise they will be certain to become re-infected.

The hot-water treatment described above is also efficient for the control of bulb mites and the larvae of the bulb flies.

(2) *Other Precautions.*—Where an area is infected with *A. dipsaci* precautions should be taken to prevent its spread to adjacent clean areas by implements, horses' hoofs, &c. All diseased leaves should be carefully collected and destroyed on the area, and infected bulbs, after lifting, should not be placed on clean areas. At present there is no cheap and efficient method of treating soil to kill the nematodes, but the worms may be starved out of an area by removing all the bulbs and growing plants such as potatoes, cabbages, and lettuces, which are not susceptible to the narcissus strain of *A. dipsaci.* In addition, all weed growth should be rigorously suppressed, as some weeds are hosts for this strain. Onions should not be grown, as these are very susceptible to attack by the narcissus strain. Such a process is difficult, and would probably take two or more years to accomplish.

Fig. 6.—Showing flower injury due to improper control of hot water treatment. Note the splitting of the petals and cup.



Phylloxera-Resistant Vine Stocks (III.)

Including Some Recent Introductions

By F. de Castella, Viticulturist

Parts I. and II. of this series appeared in the June and October, 1935, issues of his Journal.

Complex Berlandieri Hybrids.

OF the several hybrid stocks of this breeding that have been raised, No. 150-15 is of outstanding value, though several others merit mention, such as, for example:—

No. 45 E.M.: *Berlandieri* x *Solonis*—Raised by Foex, many years ago. This stock, which will be seen to be of rather similar breeding to No. 31 R., may prove of service in salty soils. Scions grafted on it are remarkably fruitful. It shows promise chiefly in cool climates, such as that of Champagne. Phénix, a Riparia x Cordfolia x Berlandieri hybrid, is another of this group that is occasionally mentioned as showing much promise, especially in the Champagne district. The Cordfolia parentage confers some of the desirable attributes of this remarkable species, which will be described presently, but it also somewhat reduces lime tolerance. According to E. Mir, it is an admirable stock for limy soils, provided the calcium carbonate content does not exceed 40 per cent. Cuttings strike with comparative ease, and it is said to hasten ripening and promote fruitfulness, but its vigour is moderate only.

No. 150–15: *Berlandieri* x *A.R.G.*1.—A Berlandieri x Vinifera-Rupestris hybrid. Though raised by Malègue of Pezilla-la-Rivière (Pyrenées Orientales, France) many years ago, recognition of its true worth is of comparatively recent date. Its pollen-parent is one of the best known and most popular of the older stocks, and it inherits from the female parent the valuable Berlandieri attributes of fruitfulness and quality amelioration. Its long neglect seems to be due to its rather poor growth when not fitted, by grafting, with a Vinifera top.

Malégue raised several seedlings of this breeding; the two that showed most promise were designated respectively 150-13 and 150-15. The first of these proved the stronger vine, hence the delayed popularity of the second. When grafted, however, their behaviour is very different; 150-15 altogether dominating its brother, both in fruit production and vigor. No. 150-15 is remarkable for its stem development, which it also communicates to the scion grafted on it, reaching a circumference of 8 inches as compared with 5⅝ inches for the same sort grafted on 150-13. The root system, which shows traces only of Phylloxera, without suffering any injury therefrom, is very fleshy and powerful. It is able to deeply penetrate stony or rocky soils. Fruit production is normal.

No. 150-15.—A Berlandieri hybrid of outstanding value. (Three-eighths natural size.)

To Prosper Gervais is due the credit of rescuing this valuable vine from oblivion. Obtaining a few cuttings from its raiser, as far back as 1900, he was so satisfied with early results that he propagated it. He regards it as a stock that should be better known and more largely used, though its lime tolerance is inferior to that of 41B and 333. Though not suited to the Cognac soils of extraordinary high lime content, it can nevertheless tolerate a fairly high proportion of this element. Augustin Bernet of Aigues Vives

(Herault), testified to its value in a difficult soil, where it was planted side by side with Nos. 1,202, 3,309, and A.R.G. 9. During the first six years, after grafting, the latter stocks seemed superior, but in the following ten years they were surpassed by 150-15. The difficulty in procuring this stock is deplored, and nurserymen are exhorted to make it available.

During the past twenty years, the qualities of No. 150-15 have met with increasing recognition, especially in Algeria, where its high drought resistance and ample lime tolerance in most soils, its freer rooting of cuttings and greater aptitude for bench-grafting than are possessed by 41B, and the fruitfulness it communicates to its scions, are duly appreciated. In compact clay-lime soils and in dry regions difficult to suit with a stock, it is, according to Professor Ravaz, to be preferred even to R.99, R.110, and 41B.

In one of the plots of the Montpellier School, grafted with Panse (Valensi), it occupies a foremost place. No. 150-13 and especially 150-15 are the finest of all; in the severest droughts the latter keeps beautifully green, its strength is maintained or increased and it seems to be the best stock for difficult soils, poor and dry.

Drought resistance seems to be its cardinal virtue. It should therefore be planted only on dry, well drained situations. Elsewhere, it may suffer from excessive moisture, for it seems to dislike "wet feet" as do also Nos. 420A and 41B. Ravaz states that it is not quite so easy to graft as 420A and 161-49. Busquet regards 150-15 as being a stock of the highest merit, excelling du Lot for growth, after the third year from plantation. He more particularly recommends it for its remarkable affinity for several "Direct Producers" difficult to suit with a stock, these having failed badly when grafted on Rupestris du Lot.

HYBRIDS OF V. CORDIFOLIA.

In Vitis Cordifolia we have another North American wild vine that presents several desirable features. It shares in large measure the drought resistance of V. Berlandieri, together with some of its other qualities—also, unfortunately, its difficult strike from cuttings—but it differs from it radically in its behaviour towards lime, of which it is very intolerant. Indeed, its susceptibility to lime-chlorosis is solely responsible for the lack of interest shown in the species during French reconstitution. Most French soils contain much lime, and on such, V. Cordifolia, and even its hybrids are out of place. In the few French "low lime" soils, Riparia x Rupestris hybrids did so well that there was no urgent need to seek anything better. The quest for new stocks centred on chlorosis resistance, in soils of high lime content. Hence the scanty references to V. Cordifolia in recent French literature. One must go back some 30 years for most of the information available concerning it. In Australia, the case is altogether different: In North-eastern Victoria and several other vine districts, the soils are conspicuous for their low lime content, and we are able to take advantage of qualities possessed of this remarkable vine, in other directions.

Like V. Berlandieri, it is a native of warm climates, an origin that lends it particular interest under Australian conditions, for most of our wine districts are much warmer than those of France. Except in the extreme South of that country, this species has difficulty in ripening its wood properly. Both as regards soil and climate, Cordifolia, and more particularly its hybrids, seem destined to play a far more important part here than they have done in France.

V. Cordifolia is, after V. Riparia, the most widely distributed wild vine in North America, occurring from Lake Ontario to Florida, though it is most plentiful in the warm Southern States. It is remarkable for its vigour, growing, in good soil, to enormous size, almost equalling V. Candicans and V. Californica, which are the largest of the North American true vines. In the wild state it climbs to the tops of high trees. Several distinct forms occur—some, of extraordinary vigour, grow wild on richer land, while types of less exuberant vegetation are found on poorer land, the differences being inherent to the variety and not due to the soil. In the breeding of the artificial hybrids now available, the more luxuriant types have been used. There should be possibilities for raising even more drought-resistant stocks, from some of the more thrifty types from poor-soil regions that seem to have been overlooked by vine breeders.

The photo reproduced from Millardet's work shows the characteristic Cordifolia leaf, which justifies its specific name, for it is distinctly heart-shaped. It has some resemblance to V. Riparia, being longer than broad, with similar thin texture, crimped or goffered

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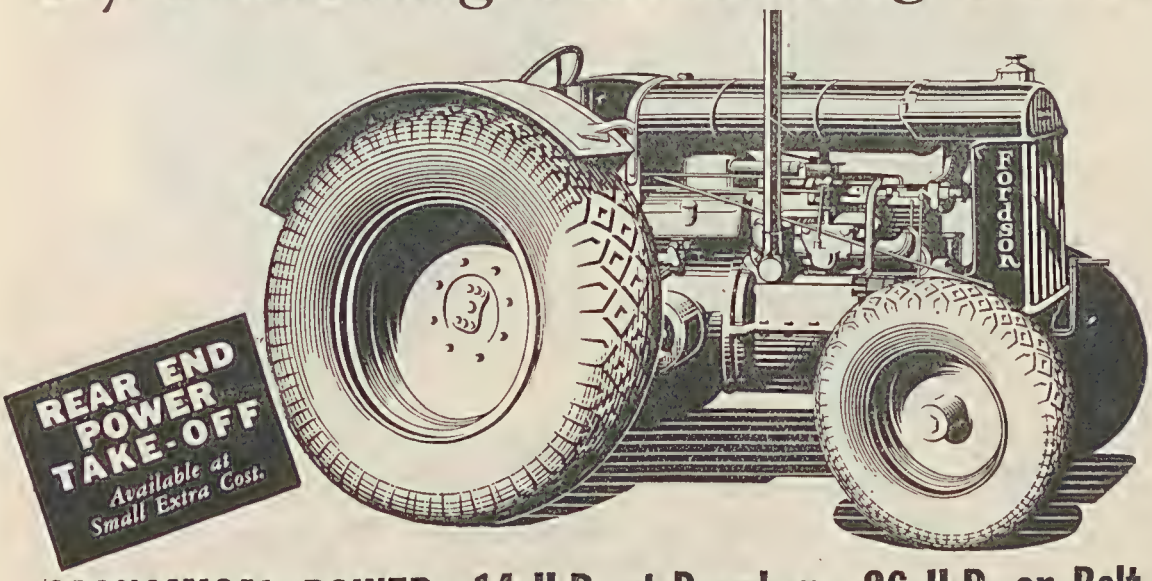

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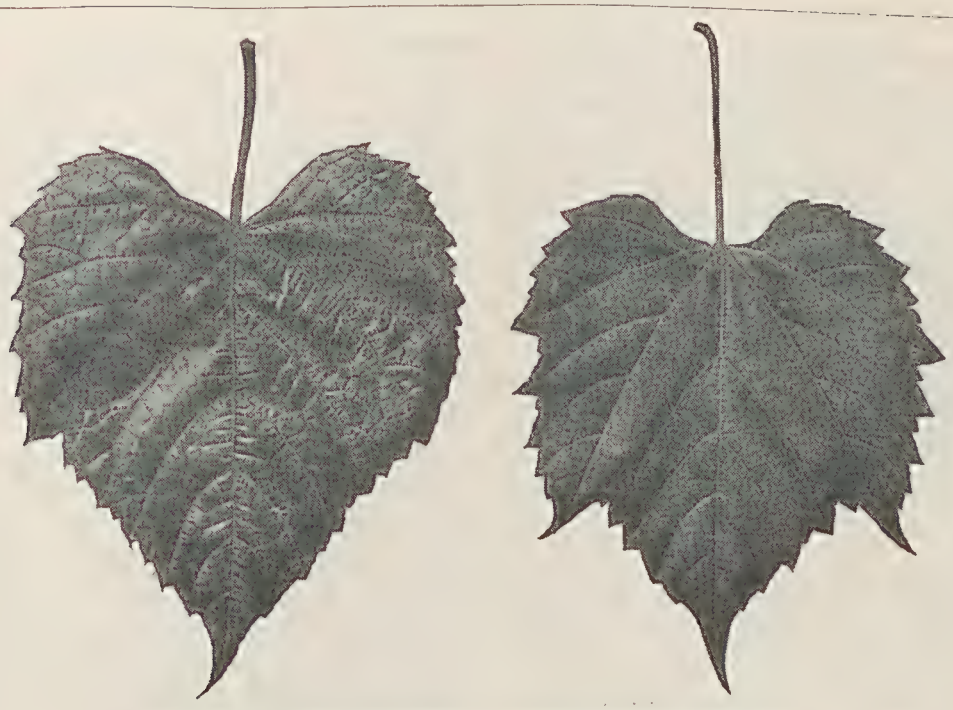

The leaves of Vitis Cordifolia and Vitis Riparia compared. [After Millardet.

between the veins. It might indeed be likened to a Riparia leaf, shorn of the fang-like terminals of the lateral lobes: the teeth are less sharp and the edges and midrib often tend to curl under.

Riparia and Cordifolia often were confused by early botanists. Riparia, which was named Vulpina by Von Linné, was considered by other authorities, to be a mere variety of Cordifolia. Michaux differentiated the two species in 1803, but there has been confusion since.

The bunch is very long and loose. The small round black berries yield little juice with a disagreeable taste. The trunk is very strong. Its powerful, fleshy, yellowish roots plunge more deeply than those of V. Riparia, and the Phylloxera resistance is of the highest order (18 by Viala and Ravaz' scale). Phylloxera galls, are, however, often plentiful on the foliage. It is a curious fact that some of the most resistant American vines are prone to development of the leaf-gall form of Phylloxera. On the other hand, galls are exceedingly rare on V. Vinifera, the roots of which have no resistance to the insect. The remarkable root system of Cordifolia enables it to thrive on stiff silty clays where other good stocks would be hopeless. Viala relates how he found it in Tennessee, growing green and vigorous on the yellowish white "crawfish soils," of carboniferous origin, that are plastic like clay when wet, but dry out exceptionally hard. The few individuals of Aestivalis and Riparia to be found in these soils were stunted (*rabougris*) and yellowish. Its remarkable adaptation for such difficult soils is perhaps the most valuable characteristic of this species.

With regard to its intolerance of lime, its behaviour is curiously inconsistent. In Texas, it often grows wild on quite limy soils. It was, on this account, recommended for similar European soils by several authorities, with altogether disappointing results. In Cognac it showed very marked intolerance of lime, succumbing to chlorosis at an early age. This seeming contradiction is explained by the influence of climate. Moist conditions considerably aggravate chlorosis. A lime content that would be fatal in France is easily tolerated in warm, dry Texas.

V. Cordifolia resembles Rupestris in its "rusticity," which enables it to thrive in poor soil, but the greater penetrating power of its roots fits it for stiff, silty soils, unsuited for Rupestris. Its drought resistance is also much higher. This was noticed by Millardet over 50 years ago, in de Grasset's vineyard, in

Herault. He comments (Loc. Cit.) on its plunging roots, that adapt it better than Riparia for the warmer parts of Europe. He further refers to its hot southern origin, in the United States of America. "It seems to me," says Millardet, "that the Cordifolias, especially those from Texas, the Indian Territory, and Arkansas, are particularly adapted to our Meriterranean region and to the hottest and driest parts of Italy and the Iberian Peninsula." He describes the proofs of drought resistance they had already given in France. "Despite the extraordinary and prolonged drought of 1881-2-3, I have never seen Cordifolias lose a single leaf in summer, whereas alongside of them Riparia, Solonis, and even Rupestris, shed their leaves and suffered visibly . . . . . the greater the heat and drought, the more intense the green of the Cordifolias and the greater the development of their shoots (*pampres*)." He deplored its poor cutting-strike, and suggested layering and the raising of seedlings, stating that de Grasset (1885) already had some thousands of the latter, already grafted, that were "second to none as regards vegetation and fruitfulness."

Ravaz supported this opinion some 25 years later, saying, "the foliage of V. Cordifolia retains its handsome verdure until the cessation of growth, where Rupestris, more particularly, shed their basal leaves. . . ." "Would this behaviour be the same if these vines had been grafted?" he asks—few examples were then available for observation. One thing, however, he holds to be certain—"The hybrids of this species, Cordifolia-Rupestris, and particularly Cordifolia-Riparia, remain very healthy and green in the driest soils." It is curious, in view of this drought resistance, that Cordifolia and its hybrids seem quite tolerant of imperfect drainage. They do not fear wet feet as do the Berlandieri hybrids.

Most Viniferas graft very easily on Cordifolia stock, for which they have excellent affinity. Ravaz points out that "the stout stem increases almost equally with the most vigorous Vinifera sorts that may be grafted on it. It communicates great vigour to the scion, in fact this sometimes may be excessive, becoming a cause of coulure and reduced yield. According to Munson, its immense size and the age it may attain, well suit it for graft stocks, though difficult propagation is an obstacle to its use in the pure state.

Concerning the pure Cordifolia stocks in the plots of Montpellier School, Ravaz and Verge report: "Very sensitive to chlorosis, yield poor. When the soil does not induce chlorosis, it yields little fruit, whether the scion be Cinsaut (Blue Imperial) or Aramon."

There is little evidence as to whether the pure species is ameliorative of wine quality or otherwise. In this connexion excessive vigour would seem undesirable; on the other hand, the retention of foliage, in efficient condition, until late in the season, that is characteristic of the species, should favour quality, as has been explained in the case of V. Berlandieri. Some of its hybrids, particularly 125-1, seem to enhance the quality of table grapes grafted on it.

The foregoing rather lengthy review of the aptitudes of this remarkable species seems to the writer to be justified, in view of its past neglect in France and promise for the future under Australian conditions. Though the pure Cordifolia has not established itself as a stock, owing to difficult propagation, coulure and lime intolerance, the first two defects have been eliminated by crossing with other species, and among Cordifolia hybrids we have several stocks of great merit for soils of low lime content. As might be expected from its wide distribution, many hybrids of Cordifolia are found in the wild state in America, it being spontaneously crossed with such other species as Riparia, Rupestris, Cinerea, Labrusca, Aestivalis, Linsecumii, and others; few of these have been tried in vineyard practice. The number of artificial hybrids is not considerable, this remarkable species having been strangely neglected by vine breeders. The following are the best known stocks:—Cordifolia x Riparia No. 125-1; Cordifolia—Rupestris de Grasset No. 1; Rupestris x Cordifolia No. 107-11; Riparia x Cordifolia-Rupestris No. 106-8; Vinifera-Rupestris x Cordifolia No. 62-66.

No. 125-1—*V. Cordifolia* x *V. Riparia*: Raised by Millardet and de Grasset towards the close of last century by pollinating V. Cordifolia with V. Riparia. Ravaz queries this breeding because a short leaf of almost Riparia Rupestris shape could scarcely be the offspring of a pure Cordifolia and a pure Riparia, the leaves of which are longer than broad. He suggests that the pollen parent may have been allied to Rupestris—"On the other hand, the root system is neither Riparia nor Rupestris, but almost entirely Cordifolia—it is fleshy, yellowish, and strongly developed." He considers it a curious plant, perhaps one

of those rare cases where there is mutation instead of the usual blending of parental characteristics. He attributes a high value to it in all but limy soils—. . . . "It surpasses in vigour the best Riparias. . . . Its strong canes strike so easily that they may be planted out directly in the vineyard, a quality that scarcely recalls V. Cordifolia. . . . The powerful root system is very Phylloxera resistant. Nodosities occur, but tuberosities are scarce and so small as to be harmless—resistance is thus very high and sufficient in all cases."

"Its powers of adaptation are low. It does not thrive on limy soils; where Riparia remains green, it becomes intensely yellow. On siliceous soils it dominates all other stocks, surpassing even the Vinifera Rupestris. At Grandmont and Couran it retains a fine dark green colour, whilst other varieties are more or less pale from drought. It thus constitutes an excellent stock for all soils, whether pebbly or otherwise: dry, poor, but not calcereous. This was, however, to be expected: Riparia, in spite of its slender roots, utilizes very effectively the soil moisture. V. Cordifolia being also refractory to drought, something of value might surely result from their union." It is very easily grafted; stock and scion develop about equally, there being no marked swelling at the union. The scions are vigorous and fruitful. The foliage is healthy. This testimony by a foremost authority, appeared in 1902, yet it failed to arouse the interest this remarkable vine deserves.

No. 125-1.—Leaf showing characteristic curve.
(Half natural size.)

No 125-1.—A Cordifolia x Riparia hybrid showing leaf flattened out.
(Five-twelfths natural size.)

The curve in the midrib, shown in the accompanying photograph, is characteristic; few leaves of this vine can be readily pressed flat.

In No. 125-1 we have a remarkable stock and a striking example of how hybridization can correct the defects of two parents, and at the same time retain their qualities. In the present case, Riparia's craving for rich land is corrected by the rustic Cordifolia, but the fruitfulness of the former is retained. The exuberant growth of Cordifolia is moderated, and the tendency to coulure is obviated. The early cessation of growth and premature leaf fall of Riparia are corrected also.

In the writer's opinion, 125-1 ranks among the best stocks for low-lime soils, and especially for hard impenetrable types. One of my regrets in connexion with our reconstitution is that more use has not been made of it in our replanted vineyards. Discussing our vineyard problems with the late F. Richter, the well-known nurseryman of Montpellier, in 1907, I explained that though we had no troubles due to excess of lime in our soils, some of them were of hard, silty types, and subject to occasional droughts. He recommended the Cordifolia hybrids, and particularly No. 125-1, as being worthy of trial. Its lack of popularity

in French vineyards, and its Riparia breeding, were not encouraging, and its propagation on a large scale did not seem justified. It was only after the establishment of our affinity plots, in 1923, that its sterling qualities manifested themselves. In these plots 125-1 is certainly one of the best stocks, though not one of the strongest growers.

Vegetative vigour is not, after all, the main consideration in a stock, else du Lot would be in greater favour than it is. The less exuberant 125-1 makes sufficient growth, communicates a higher measure of fruitfulness to vines grafted on it, while its lesser "top hamper" is not so exacting in its demands on soil moisture. Slightly closer planting easily compensates for the somewhat smaller size of the vine.

At the Viticultural Station 125-1 is grafted with seventeen different scion sorts, three of which are drying grapes, five are table grapes, and nine are wine grapes. All are doing well, affinity being quite satisfactory in every case. Most of the vines are very fruitful, especially Montils, Piquepoul, Tempranillo, Miguel de Arco, Sultana, Zante, Gordo Blanco, and Rosaki (Waltham Cross); Clairette fails to hold its fruit, but this is a defect shown on nearly all the stocks on which it has been tried. Traminer and Mataro bear rather light crops on it. For Ohanez, which is unsatisfactory on many stocks, it shows excellent affinity, though the yield of fruit was rather light. Piquepoul yields abundantly on this stock; there is indeed a tendency to over-production, easily countered, however, by hard pruning. For Gordo Blanco (Muscat of Alexandria), notoriously difficult to suit, 125-1 seems to be one of the best stocks, both as regards affinity and fruit; it seems to have an improving influence on quality and berry size. The finest Rosaki (Waltham Cross) grapes, at the Viticultural Station, have for several years been borne by vines grafted on this stock. Concerning its influence on wine quality, little evidence is available, but the late leaf fall, characteristic of Cordifolia and its hybrids, should make for amelioration, as with Berlandieri hybrids. It also inherits the Cordifolia tolerance of "wet feet," and is less susceptible to imperfect drainage than du Lot and the Riparia-Rupestris hybrids.

All things considered, 125-1 is a remarkable stock, worthy to rank among the very best on all soils that do not contain a notable proportion of lime, but more particularly for those of stiff silty nature and liable to drought.

Cordifolia Rupestris de Grasset No. 1.

This stock merits brief mention, though its chief interest lies in its being the pollen parent of No. 106-8, which will be dealt with later.

The original vine was a supposed Cordifolia, selected on account of unusual vigour by de Grasset in 1880, together with half a dozen others, from a consignment of Cordifolia plants obtained from the Indian Territory and Arkansas. These vines were later determined to be not pure Cordifolias, but wild or spontaneous hybrids between this species and V. Rupestris. The most vigorous of the lot was marketed under the designation "Cordifolia Rupestris de Grasset No. 1." Ravaz holds that the Rupestris parent predominates, especially in the foliage, though the characters of both parents are very apparent. It is a vigorous vine, with stout canes that strike fairly easily. The powerful root system is yellowish and rather fleshy; though phylloxera are occasionally found on it, its resistance is ample in all soils. It grafts less easily than some other stocks in France, where the ripening of its wood is not always satisfactory; once knitted, however, the grafts grow strongly. It is a good stock for dry, sandy clay soils.

Notwithstanding its qualities, this stock is seldom mentioned in modern French vine literature. It is not grown in Australia. Of the few cuttings imported by the writer in 1908, none survived the voyage.

No. 107–11. *Rupestris* x *Cordifolia.*—This is of somewhat similar breeding to the last-mentioned plant, though it is an artificial and not a wild hybrid. It was raised by Millardet and de Grasset many years ago, Cordifolia being the pollen parent. In common with other Cordifolia hybrids, lime intolerance is responsible for the small part it played in French reconstitution, for it is a remarkable stock in soils of low lime content. Owing to its great vigour, however, it is an undesirable stock for vines liable to coulure at blossom.

The leaf is intermediate between those of the two parents. In general outline, the result is curiously similar to a shortened Riparia, a species not related to it in any way. It has a somewhat Rupestris texture combined with the "crinkle" characteristic of Cordifolia.

A Rupestris x Cordifolia hybrid, No. 107-11. (Half natural size.)

It has a very powerful and abundant root system, young rootlings showing a bunch of strong fleshy roots, almost suggestive of a young asparagus plant. It is attacked very little by phylloxera. Success in grafting is good. It supports vigorous and fruitful scions in all soils of low lime content, whether pebbly or compact silty clay. It has not, however, the drought resistance of some other hybrids.

At the Rutherglen Viticultural Station, it is an excellent all-round stock. It has been grafted with twenty different scion sorts, for every one of which, including such bad scions as Gordo, Ohanez, and Gianetti, it shows altogether satisfactory affinity and remarkable growth. In this last respect its strength may sometimes be even excessive; with some scion sorts, the yield is not quite equal to that of the same vine grafted on more moderate stocks, such as 125-1. Contrary to expectations, however, Clairette holds its fruit better on this stock than on 125-1, and the shy-bearing White Sauvignon also yields well on it.

For poor land and scion sorts which do not fear coulure, 107-11 is an excellent and strong growing stock. It seems of special value for heavy-bearing sorts that set their fruit well, but make only moderate growth, its vigour countering the tendency to suffer from over-production. As examples, Piquepoul, Alicante Bouschet, and Terret Bourret may be mentioned; for such sorts and on poor land it is a stock of great promise. In a low-lying section at the Viticultural Station, it shows marked tolerance of rather unsatisfactory drainage conditions.

No. 106-8. *V. Riparia* x *Cordifolia-Rupestris.*—Raised by Millardet and de Grasset in 1882, when flowers of V. Riparia were fertilized with pollen of Cordifolia Rupestris de Grasset No. 1. According to Ravaz, the influence of the Riparia parent (the seed-bearer) predominates. The leaf is of shortened Riparia type, the flattening it was subjected to when photographed scarcely shows the curve of the midrib, which is similar to that of No. 125-1. It is a vigorous vine, with long, rather slender canes, which strike easily from cuttings. The root system is branched, slender, and hard, recalling that of Riparia or Rupestris. Phylloxera resistance is very high. Like all Cordifolia hybrids, it is liable to chlorosis, and is out of place in limy soils. Prosper Gervais recommended it for silty clays that become hard after rain and dry out quickly, as well as for non-calcareous pebbly soils.

Though its breeding is only one-quarter Cordifolia, it inherits in large measure the drought resistance of that species, together with the penetrating power of its roots, that suits it for hard dry soils. It was highly praised by G. Muff, Departmental Professor

No. 106-8.—A Riparia x Cordifolia-Rupestris hybrid. (Five-twelfths natural size.)

of Agriculture at Albi, in the Armagnac district S.W. France), at the Viticultural Congress of Montpellier in 1911. He held it to be the ideal stock for what are known in France as *Terres Battantes,* soils characterized by low lime content, but which contain a high proportion of exceedingly fine sand or silt. After heavy rain, they set tightly, and dry out without cracking. In these difficult soils, where several other good stocks have proved unsuitable, 106-8 is the most popular stock. It is, as a matter of fact, the best known and most extensively grown of the Cordifolia stocks in Europe and elsewhere. It is difficult to understand why it has so far surpassed its three-quarter brother, No. 125-1 in popularity, as the latter seems preferable to it in several respects. Likewise in California,* it is stated to be "a vigorous variety with somewhat slender canes, which root easily. It is particularly suited to gravelly soils and to clay soils which become hard after the rains." No mention is made of No. 125-1, or any other Cordifolia hybrid.

A terminal spray of No. 62-66, showing characteristic folded leaf.

In Australia, it is the only Cordifolia grown in commercial vineyards. It generally has given satisfactory results, its affinity with most scion sorts being good, but it seldom shows outstanding superiority over others, such as the Riparia Rupestris hybrids. In vigour it is scarcely their equal. Perhaps it has not been tried on the class of soil where superiority is claimed for it.

Some table-grape growers near Sydney favour No. 106-8 for Snow's Muscat Hamburg, which colours its fruit early on it, as on Riparia Gloire. Mr. Lackie, Superintendent of Griffith Nursery, reported a yield at the rate of a little over 10 tons of Syrah (Shiraz) per acre on this stock at the 1931 vintage. Sultana had also given two excellent crops in succession, though the vines subsequently weakened. It was also satisfactory grafted with Grenache and Doradillo.

It has been planted in several Rutherglen vineyards. Malbeck, so prone to coulure on several good resistants, seems to hold its fruit better on this stock. At the Viticultural Station it is grafted with twenty different scion sorts, affinity being generally satisfactory; it is open to doubt only in the case of Piquepoul, Ohanez, and Gianetti. In the majority of cases, however, vegetative vigour was scarcely sufficient. It is reported a good stock for Gordo Blanco; though affinity seems quite satisfactory, the vines are rather on the small side, as is also the case for several other scions.

Although it is undoubtedly a stock of merit, it scarcely seems to justify, at least under our conditions, the high praise given to it in some European quarters. It scarcely grows into a big enough vine. In the writer's opinion, No. 125-1 is generally superior to it for the same class of soil.

No. 62–66. *Vinifera-Rupestris* x *Cordifolia.* —Raised by G. Couderc a good many years ago, the seed-bearing parent being No. 3103 (Gamay Couderc), a Colombeau (Vinifera) x Rupestris hybrid, also of Couderc's raising; and the pollen parent, V. Cordifolia. It is thus a ternary hybrid of three-quarter American origin. The foliage, though characteristic, has little of V. Cordifolia about it, so little indeed as to raise doubts concerning the authenticity of its reputed parentage, especially as Cordifolia is said to be its pollen parent. The illustration shows a general outline recalling V. Rupestris; the texture is also more like this species, though of a lighter, bright green. The leaves curl inwards above, and are distinctly folded along the midrib. This is distinctly shown in the first illustration; the second being flattened out to show the general shape.

(*Continued on page* 576.)

* Bull. 331 Uni. of Calif. Publications].

Orchard and Garden Notes

By Edward E. Pescott, F.L.S.

The Flower Garden.

IT may seem strange to discuss autumn flowers before we have had summer blooms; however, a gardener always looks ahead. Preparations should be made at once for Dahlia planting, especially if the plants are to be grown in a bed by themselves. The beds should be dug over, roughly levelled, and sown down with some crop for green manure. Quick-growing crops are required, so that barley or mustard, or both may now be sown. Early in December the crops must be dug in, and from the middle to the end of the month, the plants or tubers may be set in their places.

A stake will be required for each plant; hardwood or jarrah is the best. The end of each stake should be dipped into either tar or thin cement; these are preservatives.

The tubers must be sorted out, and any long shoots that may have developed should be cut back, and each large tuber clump divided into smaller pieces; every piece, however, should show a strong bud. These pieces should then be set in the beds alongside each stake.

This is the time to lift all bulbs that are to be stored. Daffodils should be lifted about every third year; Hyacinths and Tulips each year; Heavenly Blue, Lachenalia, and similar bulbs, need be lifted only when they become over-crowded. After air-drying, the bulbs should be protected by a good dusting of lime, and stored in dry boxes in a cool place.

The Orchard.

The lack of bees in several orchard districts this spring is viewed with concern by orchardists, and rightly so; for their absence at flowering-time means a considerable diminution of pollination, and a consequent decrease in the setting of fruit.

A Cactus Dahlia.

It is difficult to completely account for their disappearance in every district, but in at least one where observations were taken, the bees in several hives had died because of the absence of a satisfactory food supply.

Bees must feed during the winter, and if there is not sufficient food available, as pollen or nectar from winter-flowering plants, artificial food must be supplied to the hives. Even the commercial apiarists have occasionally to feed their bees through the winter, when there is a shortage of natural supplies of food.

To cope with the absence of bees in his district, Mr. W. P. Mair, of Tyabb, has this season introduced over 100 hives into his orchard from Toolern Vale, in order to provide pollenation for the flowers.

It is too late now for any one to take action this year; but it should be remembered that there are two requirements at flowering-time—the provision of one or more varieties or types of pollen for crossing, and the presence of a goodly number of bees.

The Vegetable Garden.

The asparagus bed should, in the cutting season, be well supplied with water. During hot days, it may be sprayed for quite a long

time. The main cutting ceases early in December. If growth be slow, a light scattering of sulphate of ammonia should be given.

Crops of beans and peas may also be fed with a light dressing of sulphate of ammonia, but care must be taken to avoid dusting the manure on the plants.

Sowing of French beans may still be made; the soil should be well-limed before the seed is sown. It will be wise to purchase seed of wilt-proof varieties; the seed of several such varieties of Canadian Wonder beans are available; Feltham Prolific is a strong-growing, free-producing variety.

Tomato plants should be set out in rows in soil that has been well manured. No weak, pale, or sickly-looking plants should be used. If any plants, after being set out, show signs of weakness or of wilt, they should be pulled out and burned. As a precaution, the place where they grew ought to be well-dusted with lime, or with copper carbonate dust.

All vegetable beds must be very freely watered, especially in hot weather. If possible, the watering should be by constant, light sprinklings; the plants will not be injured if watered from overhead, even during the very sunny days of summer.

Phylloxera-Resistant Vine Stocks

(*Continued from page* 574).

In No. 62-66 we have a stock that has less to recommend it than the other Cordifolia hybrids. It presents, nevertheless, some good points that make it really desirable, but only for certain scion sorts and certain soil conditions. It should be limited to such, and its indiscriminate planting would be ill-advised. It was recommended to me in France as one of the most promising stocks for Muscat of Alexandria (Gordo Blanco), but even for this scion, though affinity is satisfactory, it does not equal several others, notably 125-1, 554-5, 106-8, the Berlandieri hybrids, and 1202. At Griffith (New South Wales) its record is disappointing, several scions being reported to have failed on it, e.g., Zante and Ulliade. Grenache showed signs of weakening, but Rosaki (Waltham) was satisfactory

At the Rutherglen Viticultural Station, No. 62-66 is grafted with twenty different scion sorts. Affinity is definitely faulty in the cases of Zante, Gianetti, and Mondeuse only. It is satisfactory, though growth is only moderate, with Sultana, Gordo Blanco, Valensi, and Doradillo. It is better with Ohanez, Purple Cornichon, Malbeck, Mataro, Alicante Bouschet, Carignane, and White Sauvignon. Rosaki (Waltham) and Grenache seem to be best on it. It seems to somewhat retard ripening in the case of Sultana. Its chief merit at Rutherglen is tolerance of faulty drainage. In the low-lying section referred to above, it is the stock that is doing best, surpassing 107-11,

The Vinifera-Rupestris x Cordifolia hybrid No. 62-66 showing leaf flattened out.
(Half natural size.)

which was second to it, and distinctly better than 1202 and A.R.G.1, which show fair tolerance of such conditions.

For a limited range of scions and for low-lying land, that is too wet in winter and spring, but hard and dry in summer, 62-66 is a stock of real value. It is reputed to have good drought resistance, but, like all Cordifolias, its lime tolerance is low.

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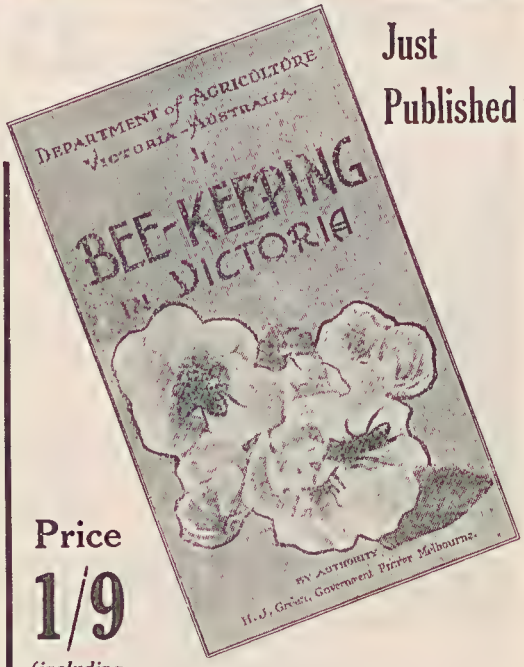

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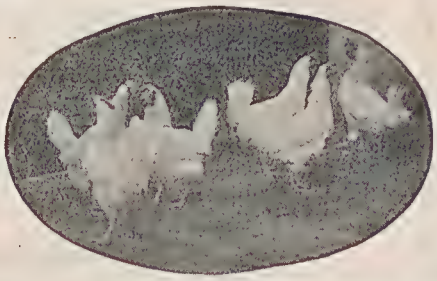

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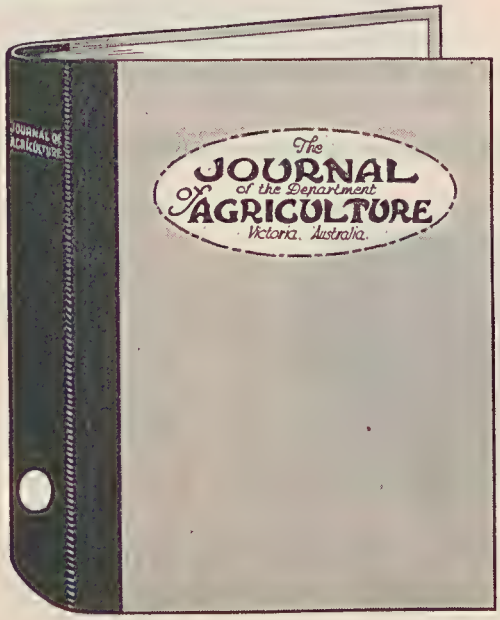

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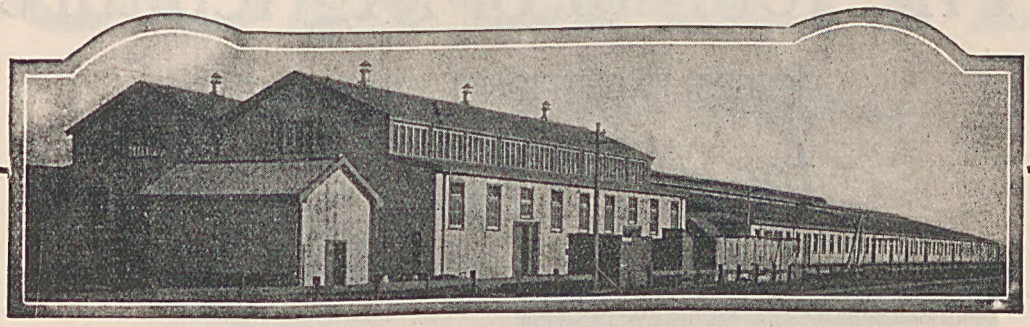

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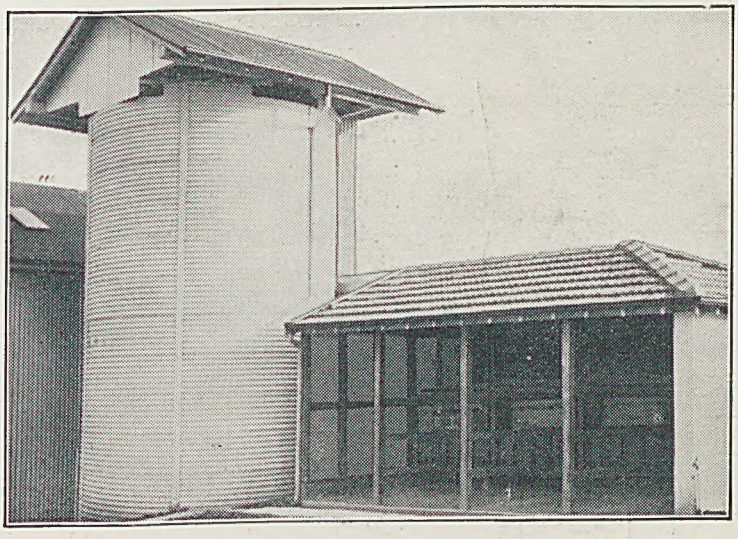

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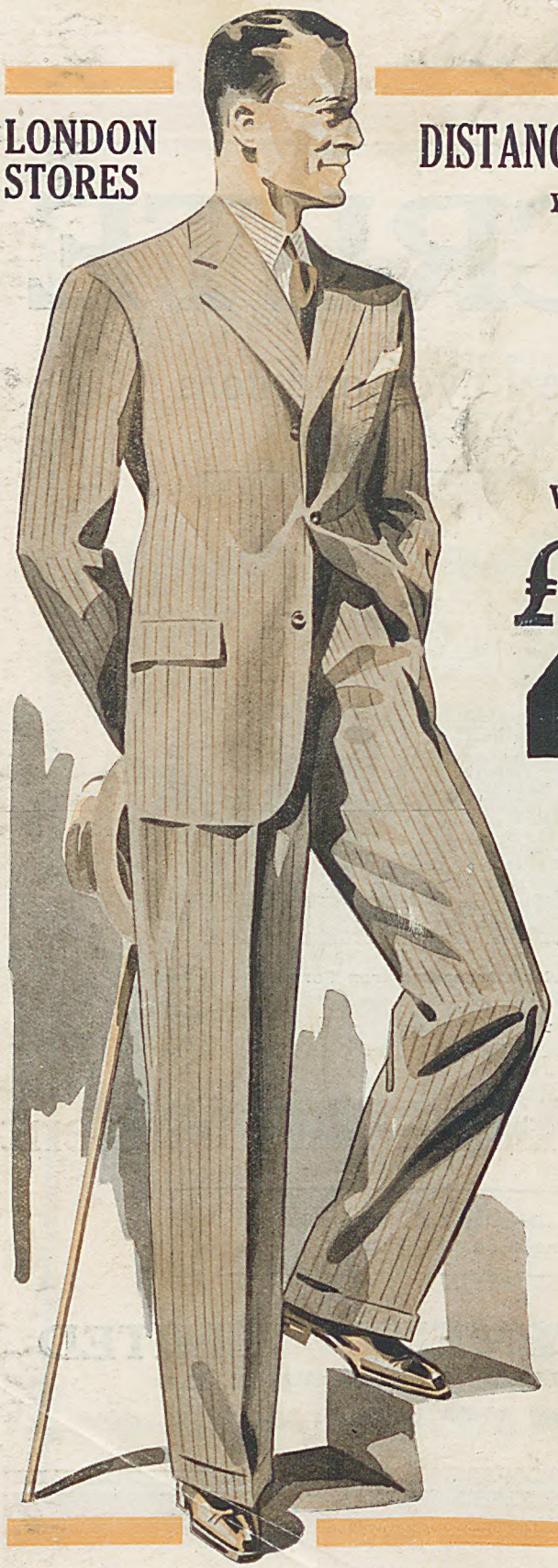

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